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TOWN SCAVENGING AND REFUSE DISPOSAL.

DISPOSAL OF HOUSE REFUSE.

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THE disposal of house refuse is usually effected in one or other of the following manners:

1. Filling low lying land with crude refuse, such land being temporarily designated "a tip" or "shoot."
2. Discharging crude refuse into the sea.
3. Separating the crude refuse by hand or machinery, and using the constituents in such trade as can profitably employ them.
4. Pulverizing the crude refuse by machinery, and using the product for manure, or in the manufacture of fuel by an admixture of tar.
5. Burning at a refuse destructor.

1. Filling Low Lying Land With Crude Refuse.—This method has been adopted by many of the metropolitan boroughs. The refuse is usually removed by contract, the authorities having to pay the contractors to remove it. The prices paid vary in the different districts, and are governed by the facilities for getting it away. The majority of the refuse removed from London is being taken by barges and deposited on the marshes at the mouth of the Thames, Swale and Medway, where there are many brickfields. The material is sometimes roughly screened before being sent away, in ordr to recover tins and iron fragments, which have a definite market value, and it is usually sorted a second time by the contractors' workmen to recover any remaining articles which are of value.

The preliminary sorting is sometimes done on platforms before the material is put into the barges, but it is more generally done in the barges themselves, as by this means less handling is incurred, since the carts can tip their contents direct into the barges.

When the barges arrive at their destination the refuse is unloaded and roughly sorted. The rough core, which consists mainly of old iron baths, tins, brickbats, etc., is usually buried in the bottoms of pits from which brick earth has been taken out. The remainder of the refuse is left in a heap, the heat in which, in the course of a few months, reduces paper and vegetable matter to such an extent that it is hardly traceable. During the winter months, when the manufacture of bricks is stopped, men turn into the heap, and sift it with a rotary sieve, the larger cinders and small coal recovered being used as fuel in burning the bricks, while the ashes are mixed with the clay used for making the bricks. Formerly there was a good demand in London for house refuse for these purposes, but latterly, owing to the depression in the brick trade, the demand has considerably decreased. This method of disposal is certainly one of the cheapest that can be adopted, as all that is required is a small wharf, and the responsibility of the authorities ceases as soon as the refuse has been delivered to the barges. There are several disadvantages, however, as in many cases the barges can only leave at high water, and sufficient material must therefore be delivered to load the barges by the time of high water, so as to make room for an empty barge to come alongside. Then, again, some provision must always be made for disposing of the refuse during times of fog, when the barges will not be able to get away.

2. Discharging Crude Refuse Into the Sea.—This system is adopted in many seaside towns, such as Liverpool, Dover, Newcastle-on-Tyne and Dublin. The refuse must be carted well out to sea and deposited under

such conditions that it may be quite impossible for it to cause any nuisance.

The refuse of Dover is taken about three miles out into the English Channel and there deposited. The barges in which it is removed hold about 70 tons each, and the cost of disposing of each barge load is £3 10s ($17.50), 1s (25 cents) per ton.

In Liverpool only a very small proportion of the refuse is disposed of by this means. In the year 1905, out of a total of 339,914 tons of refuse collected, only 42,284 tons were dealt with in this manner.

In Newcastle-on-Tyne, in the year 1906, 56,000 tons were barged to sea, out of a total of 154,653 tons of refuse collected.

Dublin formerly disposed of about one-third of the total amount of refuse collected each year by conveying it out to sea, but the greater portion is now being dealt with in destructors, owing to the fact that the Port Board called for the removal of the refuse barge from its berth at a central position in the city to a point three miles out, thereby greatly increasing the cost of cartage.

3. Separating the Crude Refuse by Hand or Machinery and Utilization of the Constituents.—This method of disposal has been attempted by several of the metropolitan boroughs in London, but has generally not been as satisfactory as was anticipated. Until recently the refuse collected in the borough of Paddington was disposed of by this means. The material was first tipped on to a grating across which it was dragged, and through which the smaller particles dropped into a receiver. The material was separated into two sizes by being passed through two sieves, the coarser material being termed "breeze," while the finer was known as "ashes." The breeze was hand-picked by women, so as to extract materials such as metals, bones, and glass, etc., the remainder consisting mainly of cinders. The ashes and breeze were disposed of to brickmakers. The refuse retained on the grating was hand sorted by men, and such articles as rags, bones, iron, lead, glass, boots, cardboard, tins, etc., were recovered, the residue being removed by a contractor, at the expense of the Council.

Th process has now been entirely discontinued, and the whole of the refuse of the borough is being barged away without any preliminary sorting.

The refuse collected in the borough of Bethnal Green is, at the present time, being disposed of in a somewhat similar manner. All the refuse brought to the works by the collecting carts is tipped on to a large grating, two-inch mesh, placed over a hopper having a small sump at the bottom. The material is raked over and any matter that will not pass through the grating is removed and burned in a furnace. The material which passes through the grating is raised from the hopper sump by an endless chain bucket conveyor. This delivers the material into a revolving screen having three different sizes of mesh, and open at the end, so that all matter which is too large to pass through any of the meshes is caught in a wagon which is placed at the open end of the screen. The whole of the matter which falls from the revolving screen is barged to various brickfields, where the fine stuff is mixed with clay and used for brickmaking, and the two larger sizes of material are used for burning the clay. The material fetches from 30s ($7.50) to £3 ($15) per barge load of 80 tons. The refuse burned in the furnace generates sufficient heat to provide its own forced draught, by means of a steam jet, which is supplied from a Babcock & Wilcox boiler. The steam pressure generated in the boiler varies from 60 to 70 pounds per square inch, and sufficient steam is generated to work a 12 horse-power Tangye horizontal engine, which drives the bucket conveyor and the revolving screen. About 100 tons of refuse are dealt with per day, of which one-third is burned in the furnace and two-thirds is passed through the revolving screen.

The refuse from the borough of Hampstead is disposed of in destructors, but the whole of the refuse collected is first sorted by a contractor, who employs his own men to do the work, and pays the Council the sum of £60 ($300) per annum for the privilege of being allowed to sort the material. The contractor employs five men to do the work, and apparently is able to make a profit from the materials after paying their wages and the sum due to the Council. The materials separated are glass bottles, broken glass, clean paper, rags, bones, boots and shoes, tins and scrap iron. Generally speaking, the system of disposal by hand separation and utilization cannot be said to be a sanitary one, although little objection can be taken on sanitary grounds to the system as carried out at Bethnal Green.

4. Disposal by Pulverization.—This process is an entirely novel one, and

CONCRETE AND BRICK BRIDGE OVER PENITENCIA CREEK ON ALUM ROCK PARK ROAD.

First concrete bridge built in Santa Clara County, Cal.

Built October, 1891. Cost, $1,000. Span, 36 feet. Roadway, 26 feet. J. G. McMillan, Engineer.

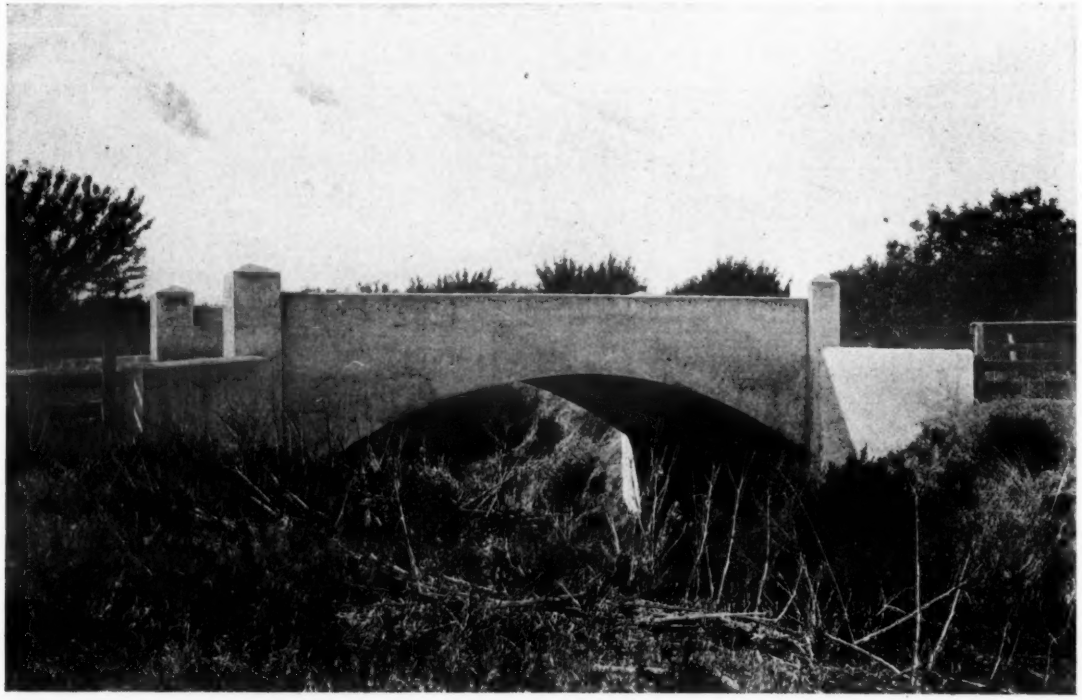
is still more or less in the experimental stage, at all events in this country, though the refuse from about one-quarter of the area of Paris is being dealt with on this system at an installation which has been erected at Vitry. The only refuse that is being disposed of by this means in England is a portion of the refuse of the metropolitan borough of Southwark. The machine employed is called a "lightning dust crusher," and consists of a comparatively small steel box containing four or six hammers, each weighing about 50 pounds, composed of special alloy steel. The axle on which these hammers hang is rotated by machinery at the rate of 800 or 1,000 revolutions a minute. The refuse is fed by shovels into the machine at the rate of four tons an hour, and comes out completely pulverized. The powder is sold as manure at the rate of 2s 2d (50 cents) per ton, which, after the working expenses and the cost of carriage have been takn into account, shows a loss of 7d (14 cents) per ton for disposal. The power required for driving the machine is between 18 and 22 horse-power.

The process adopted at Vitry is somewhat different. A preliminary screening is done to sort out large articles, such as tins, paper, bottles, wire, crockery, etc., which are collected and sold. The rest of the material is passed into the pulverizers, on coming from which it is delivered onto a screen having a mesh of three-fourths inch. The material which passes through the screen falls into a hopper, from which it is discharged into railway trucks drawn up underneath, and is used for manure. The material which is too large to pass through the screen is discharged into a hopper, from which it is raised and discharged by means of a shoot over a furnace. At the bottom of the shoot is fixed an Archimedean screw, which draws the matter forward and distributes it over the furnace, in which it is rapidly burned, and the steam generated from its combustion is utilized to provide the power required for driving the plant.

5. Burning at a Refuse Destructor.—This method has of recent years been more generally adopted, mainly on sanitary grounds, in those districts where an absence of any other more economical system of disposal has forced the authorities to adopt this system, as no destructor has yet been made to pay its own way by the utilization of the residuals. In some instances a proportion of the cost of disposal has been recovered, either by the generation of heat which has been transformed into energy, or else by the manufacture of marketable products from the residuals. There are a number of types of destructors upon the market, amongst which may be mentioned those of Messrs. Manlove, Alliott & Co., Horsfall & Co., Goddard, Massey & Warner, Hughes & Sterling, and Heenan & Froude.

The general principles of destructor design may be briefly described as follows: A large grate area is provided on which the refuse to be burnt is deposited. The material is sometimes fed onto the grating by means of what is known as a "top feed," that is to say, a shaft is constructed rising vertically from the back of the furnace to a platform above, so that the refuse may be tipped either onto the platform and raked from there into the furnace, or else may be tipped directly from the carts into the furnace. This is the more general method. The alternative methods are to shovel the material onto the gratings through openings provided either in front or at the back of the furnaces, which systems are known respectively as the "front" and "back" feeds. A forced draught is required both to assist in burning the material and also to aid in producing a high temperature, in order that any noxious fumes may be thoroughly cremated before they are permitted to escape into the open air. The forced draught is sometimes supplied by means of steam jets, and in other cases by means of fans. The draught is in some types admitted immediately beneath the gratings at the front of the furnace, and in others through openings provided in the side walls. As an aid to inducing a draught and also in order to disseminate the gases created in such a manner that they may cause as little nuisance as possible, chimneys are generally constructed in connection with the destructors, and in most cases a dust catcher is provided between the destructor and the chimney to arrest any fine particles of matter which may not have been entirely burnt.

The aim of every design of destructor is to raise as much steam as possible, while securing complete combustion. In many cases, also, the heat of the waste gas is utilized, either to heat the air for the forced draught, or the feed water for boilers, or else to superheat the steam generated by them in cases where this is used for purposes other than merely producing the forced draught. By heating the



CONCRETE BRIDGE OVER STEVENS CREEK ON MOUNTAIN VIEW DEPOT ROAD, SANTA CLARA COUNTY, CAL.
Cost, $1,473. Span, 36 feet. Roadway, 20 feet. J. G. McMillan, Engineer.

air supply, the temperature is kept more constant, and therefore the wear and tear of the cells will be less. It also makes it easier to fire up after clinkering. If the feed water is heated before being supplied to the boilers, their working will be more regular, and therefore the wear and tear will be less, while a larger quantity of steam will also be developed. The advantage of superheating the steam lies in the fact that the loss due to condensation in the pipes and cylinders of the engine which it may be used to drive will be considerably diminshed. A further advantage gained by the utilizing of the heat contained in the waste gases is that their temperature being reduced before they are transmitted to the chimney, the life of the latter will be prolonged.

Choice of Site for a Refuse Destructor.—In selecting the site for a refuse destructor several considerations have to be borne in mind. From the point of view of lessening the amount of carting to be done in collecting the house refuse, it should be placed in a central position. In order to make it pay its way as far as possible it should be placed in such a position that the steam raised may be used, and that the residuals produced may be utilized to the best advantage. It will generally be very difficult to find a site which will fulfill both these conditions without being unduly expensive, as the central portions of most towns are usually those in which the site values are the highest. The disappointing results which have attended the working of most of the destructors of the metropolitan boroughs of London may be directly attributed to the difficulty of finding sites which will comply with the required conditions. Excessively high rents and the high prices of labor cause heavy working expenses, while there is considerable difficulty in disposing of the clinker produced, owing to the cost of carriage and competition from destructors situated in outlying districts, since there is no great demand for the material in London itself. Indeed, it is quite an open question whether it would not be found more economical to remove the whole of the London refuse to destructors situated in the country, where land and labor would be much cheaper and where a real demand exists for the refuse for manure and for the clinker for building purposes.

At many destructors the steam generated is used in connection with the generation of electricity, but this cannot be done in many instances in London, owing to the fact that the electricity undertakings are in the hands of private companies. The best uses to which steam generated by destructors can be put are the pumping of a town's water or sewage or for electric lighting or traction, as for these purposes the power will be required almost continuously throughout the whole twenty-four hours. Other uses to which it has been put are the heating of buildings, driving of laundry machinery and machinery in connection with slab and brickmaking plants.

SPECIFICATIONS FOR SHEET ASPHALT PAVEMENT.*

SUB-DRAINAGE.—When the soil is of such a character that it retains an excessive amount of moisture, such as clays subject to swelling or heaving under the action of frost, or sands similar to quick sand that do not afford a ready natural drainage, sub-drains should be provided. These may be of two general kinds: (1) Tile drains of open porous material, or vitrified tile laid with open joints; (2) trenches filled with broken stone, gravel, cinders or other similar material.

In some cases it may be sufficient to construct a sub-drain on each side of the roadway at or near the lines of the gutters, but when the soil is of a very wet nature, it may be advisable to lay additional lines of drains which may be in or near the middle of the roadway. This system of drains may be varied by diagonal lines of drains running from near the crown of the roadway to the gutters. In all cases the drains should have connections with the existing sewers, catchbasins or inlets.

Foundations.—After all necessary grading has been done to bring the surface to sub-grade, the street shall be thoroughly rolled with a steam roller weighing not less than ten tons. If settlement occur, the depression

*Report of Asphalt Committee of the Organization for Standardizing Paving Specifications.

CONCRETE BRIDGE OVER COYOTE CREEK ON BERRYESSA ROAD, SANTA CLARA COUNTY, CAL.

Cost, $13,332. Spans, two—one 68 feet, one 40 feet. Roadway, 68 feet. J. G. McMillan, Engineer.

shall be filled and then rolled until the surface is solid and uniform. All filling shall be free from animal or vegetable matter, and of a character approved by the engineer. Should the foundation be of sand, which would be impracticable to roll, the entire roadway from curb to curb shall be thoroughly puddled by flooding with water one or more times if found to be necessary. The contractor shall furnish all water and hose for puddling and all the labor necessary to properly perform the work.

Refined Asphalt.—The refined asphalts to be used for paving mixtures herein required shall be derived in the following manner:

1. By heating, if requiring refinement, crude, natural, solid asphalt, to a temperature of not over 400 degrees F. until all the water has been driven off. Crude, natural, solid asphalt shall be construed to mean any natural mineral bitumen, either pure or mixed with foreign matter, from which, through natural causes in the process of time the light oils have been driven off until it has a consistency harder than 100 penetration at 77 degrees F. At least 98½ per cent. of the contained bitumen in the refined asphalt which is soluble in cold carbon bisulphide shall be soluble in cold carbon tetrachloride. Such asphalt must melt readily upon the application of heat. In no case shall it be prepared at the refinery with any product not hereinafter provided for.

2. By the careful distillation of asphaltic petroleum until the resulting residue has a consistency not harder than 40 penetration at 77 degrees F.

(a) The solid residue so obtained shall be soluble in carbon tetrachloride to the extent of 98½ per cent.

(b) Its bitumen shall yield upon ignition not more than 15 per cent. of fixed carbon.

(c) When 20 grams of the material are heated for five hours at a temperature of 325 degrees F. in a tin box 2½ ins. in diameter, after the manner officially prescribed, it shall not lose over 5 per cent. by weight, nor shall the penetration at 77 degrees F. after such heating be less than one-half of the original penetration.

(d) A briquette of the solid residue having a cross-section of one square centimeter shall have a ductility of not less than 30 centimeters at 77 degrees F.

Note: Combinations of asphaltic and semi-asphaltic residues having the ductility and other characteristics above named are admitted under Section 2.

3. By combining at the paving plant in uniform and fixed proportions which shall be satisfactory to (proper city official) solid, natural asphalt and solid asphaltic residue as hereinbefore described. The refined natural asphalt shall be derived from the crude natural asphalt of the quality and in the manner specified before, except that the crude natural asphalt may have added to it, if desired, at the refinery, as a partial fluxing, an amount of asphaltic or semi-asphaltic flux of the character and within the limit specified elsewhere herein, such fluxing to be conducted under the supervision of (proper city official) when desired. In the use of these mixtures of refined asphalts or asphaltic cements only asphaltic or semi-asphaltic fluxes shall be used, except in those cases where the solid natural asphalt is of such character that when mixed with paraffine flux without the further addition of any other material it will produce an asphaltic cement complying with the requirements hereinafter set forth under that head. In such cases any of the fluxes elsewhere herein specified may be used.

The preparation and refining of all asphalts admitted under these specifications shall be subject to such inspection at the paving plants and refineries as the (proper city official) may direct.

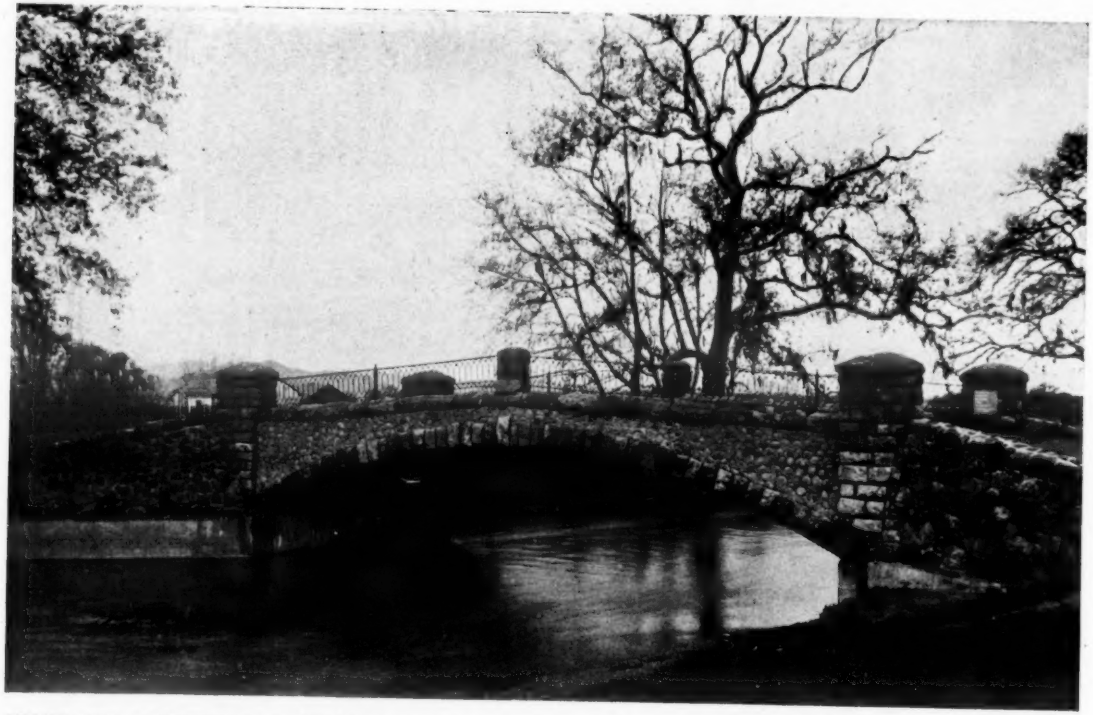
Flux.—The fluxing may be a paraffine, a semi-asphaltic or an asphaltic residue which shall be tested with and found suitable to the asphalt to be used. It shall be free from water or other impurities.

The residuums must have a penetration greater than 3½ centimeters, with a No. 2 needle at 77 degrees F. under 50 grams weight for 1 sec.

A natural Maltha may be used if it passes the heat and flash tests specified under "a" (below), and all fluxes must furthermore remain soft after heating for five hours at 400 degrees F.

All residuums shall be soluble in cold carbon tetra-chloride to the extent of 99 per cent.

(a) The paraffine residuum shall have a specific gravity of 0.92 to 0.94 at 77 degrees F. It shall not flash below 350 degrees F. when tested in the New York State closed oil tester, and shall not volatilize more than 5 per cent. of material when heated five hours at 325 degrees F. in a tin box 2½ ins. in diameter as officially prescribed. The residue after heating shall flow at 77 degrees F. and shall



STONE AND CONCRETE BRIDGE OVER LLAGAS CREEK ON LEAVESLY ROAD, SANTA CLARA COUNTY, CAL.
Cost, $3,703. Span, 48 feet. J. G. McMillan, Engineer.

be homogeneous, and shall show no coarse crystals.

(b) Semi-asphaltic residuum shall have the same general characteristics as paraffine residuum, except that it shall have a specific gravity of .94 to .98 at 77 degrees F.

(c) Asphaltic residuum shall have the same general characteristic as paraffine residuum, except that the specific gravity shall not be less than .98 nor more than 1.04 at 77 degrees F. The asphaltic residuum after evaporation at 500 degrees F. to a solid penetration shall have a ductility of not less than 30 cm.

Asphaltic Cement.—The asphaltic cement prepared from materials above designated shall be made up from the refined asphalt or asphalts, and the flux, where flux must be used, in such proportions as to produce an asphaltic cement of a suitable degree of penetration. The proportion of the refined asphalts comprising the cement shall in no case be less than 40 per cent. by weight.

When weight of flux in the asphaltic cement prepared from solid natural asphalts exceeds 25 per cent. thereof, asphaltic or semi-asphaltic flux shall be used. Semi-asphaltic flux in such case must have a gravity of not less than .95 at 77 degrees F.

Refined asphalts and flux comprising the asphaltic cement shall, when required, be weighed separately in the presence of the authorized inspectors or agents of (proper city officials).

Refined asphalt and flux used in preparing the cement shall be heated together in a kettle at temperatures ranging from 250 degrees to not over 375 degrees F., and be thoroughly agitated when hot by air, steam or mechanical appliances, until the resulting cement has become thoroughly mixed into a homogeneous mass. The agitation must be continued during the entire period of preparing the mixtures. Cement shall always be of uniform consistency, and if any portion should settle in the kettles between intervals of using the same, it must be thoroughly agitated before being drawn for use.

The asphaltic cement shall have a penetration of from 30 to 100, which shall be varied within these limits to adapt it to the particular asphalt used in the paving mixture and to the traffic and other conditions of the street.

(a) When 20 grams of the asphaltic cement of the penetration to be used in the paving mixture shall be heated for five hours at a temperature of 325 degrees F., in an oven as officially specified, there must not be volatilized more than 5 per cent. of the bitumen present, nor shall the penetration at 77 degrees F. after such heating be less than one-half of the original penetration.

(b) The bitumen of the asphaltic cement shall give upon ignition not more than 15 per cent. of fixed carbon.

(c) A briquette of the pure bitumen of the asphaltic cement of the penetration to be used in the paving mixture, having a cross-section of 1 sq. cm., shall elongate to the extent of not less than 10 cm. nor more than 100 cms. at 77 degrees F.

Sand.—The sand shall be hard-grained and moderately sharp. It shall be free from loam or any other foreign material, and shall be so graded as to produce, in the finished surface mixture, the mesh requirements elsewhere herein specified. It shall contain not to exceed 6 per cent. of sand that will pass a No. 200-mesh sieve.

Binder Stone.—Stone or gravel to be used for asphaltic concrete binder shall be hard and durable, free from all foreign substances, and of varying sizes, from 1 in. down.

Preparation of Asphaltic Concrete Binder. — Asphaltic concrete binder shall be made as follows: The binder stone and sand, as above specified, shall be heated to from 200 to 325 degrees F. in suitable appliances. Stone and sand shall be measured off separately and then be mixed with sufficient asphaltic cement, prepared as heretofore specified, in such proportions that the resulting aggregate will contain by weight material passing a No. 10 mesh screen, between 30 and 40 percent. and bitumen in quantity from 5 to 8 per cent. of the entire mixture. Concrete thus prepared shall be a compact mass containing a minimum of voids. If the permission of (proper city officials) be available, old asphaltic surface paving mixtures may be used in combination with the binder stone, such mixtures having been previously crushed or disintegrated and augmented with at least 1 per cent. of fresh asphaltic cement, so that when combined the resulting concrete shall form an equally compact mass and correspond as to aggregate passing a No. 10 mesh screen and in contained percentages of bitumen with the requirements for the mixture previously specified.

Note: Inasmuch as the percentage of bitumen in the binder will depend upon the grading of the aggregate, the proportions of the materials used in the above may be varied by (author-

CONCRETE BRIDGE OVER GUADALYPE CREEK, SANTA CLARA COUNTY, CAL.
J. G. McMillan, Engineer.

ized city official), but only within the limits designated.

Laying Asphaltic Concrete Binder.—The asphaltic concrete binder shall be brought to the work in wagons, covered with canvas or other suitable material, and upon reaching the street shall have a temperature of 200 to 325 degrees F. It shall be placed upon the street and raked to a uniform surface to such depth that, after being rolled and thoroughly compacted, it shall have a thickness of —— ins. The surface, after compression, shall show at no place an excess of asphaltic cement, and any spot covering an area of 1 sq. ft. or more showing an excess of asphaltic cement shall be cut out and replaced with other material. Smaller spots may be dried by the use of stone dust and smoothers. Any asphaltic concrete binder broken up during the process of laying must be removed and replaced with new material. Asphaltic concrete binder shall be followed and covered with wearing surface as soon as is practicable in order to effect the most thorough bond between the binder and the wearing course.

Asphaltic Surface Mixture or Wearing Course.—The committee, in presenting two kinds of mixtures for wearing surface, one having as filler Portland cement and one with a stone dust filler, considers that the adoption or application of either would be a matter of local conditions, and accordingly should be left to the discretion of the engineer in charge of such paving construction.

The surface mixture shall consist of asphaltic cement, Portland cement (stone dust) and sand, proportioned by weight so that the resulting mixture will contain average proportions of the whole mixture as follows:

Mixture A.	Per Cent.
Bitumen soluble in cold carbon bisulphide	11.0 to 13.5
Portland cement passing a No. 200 sieve	10.0 to 15.0
Sand passing a No. 80 sieve	18.0 to 36.0
Sand passing a No. 4 sieve	up to 10.0

Mixture B.	Per Cent.
Bitumen soluble in cold carbon bisulphide	10.5 to 13.5
Stone dust passing a No. 200 sieve	10.0 to 15.0
Sand passing a No. 80 sieve	18.0 to 36.0
Sand passing a No. 40 sieve	20.0 to 50.0
Sand passing a No. 10 sieve	8.0 to 20.0
Sand passing a No. 4 sieve	up to 10.0

The item designated as "Portland cement (stone dust) passing a No. 200 sieve" within the limits named herein, includes in addition to the Portland cement (stone dust) find sand passing a No. 200 sieve not exceeding 4½ per cent. of the total mixture, and such 200-mesh mineral dust naturally self-contained in the refined asphalt.

Sand and asphaltic cement shall be heated separately to about 300 degrees F. The maximum temperature of the sand at the mixers shall in no case be in excess of 375 degrees F., and the maximum temperature of the asphaltic cement shall not exceed 325 degrees F. at the discharge pipe. The Portland cement (stone dust) shall be mixed with the hot sand in the required proportions, and then these shall be mixed for at least 1 minute with the asphaltic cement at the required temperature, and in the proper proportions in a suitable apparatus, so as to effect a thoroughly homogeneous mixture.

The proportion of asphaltic cement shall at all times be determined by actual weighing with scales attached to the asphaltic cement bucket. The Portland cement (stone dust) and sand must also be weighed, unless a method of gauging approved by the (authorized city official) shall be used. The contractor shall furnish every facility for the verification of all scales or measures. The sand gradings and bitumen may be varied within the limits designated, in the discretion of (proper city official).

Laying the Wearing Surface.—The asphalt wearing surface shall be hauled to the work in wagons provided with a canvas or other suitable cover. It shall leave the plant at a temperature between 250 and 325 degrees F., as suitable for the asphalt used. Upon arrival at the street it shall be dumped at such distance from the work that all of the mixture must be turned and distributed to the place where it is to be raked. It shall be spread, while hot, to such depth upon the asphaltic concrete binder, which must be thoroughly dry, free from leaves or other foreign matter, that after receiving its ultimate comprission by rolling it shall have a thickness of —— ins. The initial compression may be effected by means of a small roller, after which a small amount of mineral dust shall be swept over the surface. The final compression shall be effected by a 10-ton roller or the equivalent of not less than 250 lbs. per running inch width. Rolling must be steadily kept up and continued until all roller marks shall disappear and the surface shall give indication of no further compressibility.

CORCRETE BRIDGE OVER LOS GATOS CREEK ON CAMPBELL AVENUE, SANTA CLARA COUNTY, CAL.
Cost, $4,077. Span, 50 feet. Roadway, 30 feet. J. G. McMillan, Engineer.

Note: All tests herein provided must be conducted according to official methods on file in the office of (proper official).

All penetrations indicated herein, unless otherwise specified, refer to the depth of penetration in hundredths of centimeters of a No. 2 needle weighted with 100 grams at 77 degrees F. acting for 5 seconds.

SPECIFICATIONS FOR BITUMINOUS CONCRETE PAVEMENT.*

(In the specifications for bituminous concrete the committee does not assume to pass on the validity of patents that may have been issued for certain paving mixtures and methods, and the various municipalities that may adopt these specifications are advised to determine their own policies as to the recognition of these patents.)

Foundation.—The foundation upon which the pavement is laid may be either concrete or macadam.

Concrete Foundation.—This may be laid according to the standard specifications for concrete foundation, the surface being made rough and grainy so the paving material may get a proper bond or grip on the concrete.

New Macadam Foundation.—If the pavement is to be laid on a new macadam foundation, the macadam shall be buiit according to the standard specifications, except that the upper ½ in. shall not be completely filled and bonded, the intention being (as with the concrete foundation) to produce a somewhat rough, grainy surface into which some the paving mixture will be forced by the roller. For heavy traffic 8 ins. of well-compacted macadam may be considered equal to 6 ins. of concrete; and for light or ordinary traffic 6 ins. of macadam equal to 4 or 5 ins. of concrete.

Old Macadam Foundation.—If the pavement is to be laid on an old macadam base, the surface shall be thoroughly swept and cleaned of all fine material that may be either caked upon the surface of the stone or lying loose as dust, thereby exposing the clean stone in the surface for the reception of the paving material. If the old macadam is not in suitable condition or proper grade after cleaning, it shall be spiked up and redressed to the proper crown and grade, the coarse stone being left at the top, or new stone added when, in the opinion of the engineer, it is needed to give the desired grainy surface or thickness of foundation.

It shall then be thoroughly rolled with the use of as little water as possible, so the macadam does not finish smooth.

When it is not practicable to secure a foundation, either macadam or concrete, with sufficient grain in the surface to give the desired bond or key between the foundation and the paving material, the adhesion between the two may be increased by sprinkling the foundation with the bituminous cement before the paving mixture is spread, using not exceeding ¼ gal. per sq. yd.

Old Brick or Granite Foundation.—An old brick or granite block pavement, if in the opinion of the engineer it is well supported and stable, may be used as a base by thoroughly cleaning the old pavement and sprinkling its surface with the bituminous cement.

Wearing surface.—On the foundation as specified shall be laid the bituminous concrete wearing surface, which shall be composed of carefully selected, sound, hard, crushed stone and sand mixed with bituminous cement and laid as hereinafter specified. This wearing surface shall have a thickness of — ins. after thorough compression with a 5-ton tandem roller.

Mineral Aggregate.—The mineral aggregate shall consists of broken stone or broken stone and sand of a fairly uniform grading from the largest to the smallest particles in such proportions as to give the mixture a maximum degree of density and low percentage of voids. The maximum size of stone used may range from that passing a screen having circular openings from ¾ in. to 1¼ ins. diameter. Crusher run of stone between 1 in. and screenings passing ¼ in. may be used if found to be fairly evenly graded. Coarser stone when used shall

*Report of committee of the Organization for Standardizing of Pavement Specifications.

be graded and remixed in proper proportion. (The screenings passing the ¼ in. mesh screen may be used when the bitumen is refined coal tar or an asphalt not having a low ductility.) Coarse and fine sand having proper grading shall be added in such proportions as necessary to secure the dense aggregate specified above. Stone dust or hydraulic cement may be added as needed when the character of the bitumen used requires it.

Bituminous Cement.—The bituminous cement may be either refined coal tar or asphaltic cement.

Coal Tar.—The coal tar must be the residue of the distillation of coal tar only, and be specially refined for the purpose. No admixture of hard pitch with the lighter oils of coal tar will be permitted. The cement shall conform to such physical and chemical tests necessary to satisfy the (local officials) as to its suitability.

(The committee does not find available sufficient data enabling the preparation of more detailed specifications at this time. It recommends careful experiments and collection of data for future consideration.)

Asphaltic Cement.—The asphaltic cement may be prepared (1) from refined natural asphalt; (2) from the residue obtained in the oxidation or distillation of asphaltic or semi-asphaltic petroleum; (3) from any uniform combination of the preceding materials together with a suitable flux, if flux be necessary, such combination being subject to the approval of the engineer.

Each bidder must state the nature and origin of the bitumen to be used by him, and further shall submit samples of the bitumen with his proposal. The asphaltic cement shall pass the requirements designated below.

(1) It shall have a penetration of 30 to 100 at 77 degrees F., which shall be suitable to the nature of the material used and to the traffic and other conditions of the street.

(2) When 20 grams of the cement are maintained at a temperature of 325 degrees F. for five hours in a tin box 2½ ins. diameter, there must not be volatilization of more than 3 per cent. by weight of the bitumen present, nor shall the original penetration be reduced thereby over one-half.

(3) The bitumen of the asphaltic cement shall give upon ignition not more than 15 per cent. of fixed carbon.

(4) Of the bitumen of the asphaltic cement which is soluble in carbon disulphide, 98½ per cent. shall be soluble in carbon tetra-chloride.

(5) At 32 degrees F. the bitumen of the cement shall have a penetration of not less than 10 when tested one minute with the needle weighted to 200 grams, and at 115 degrees F. when weighted to 50 grams for five seconds, shall have a penetration of not more than 280.

(6) The cement shall not flash at a less temperature than 350 degrees F., New York State closed oil tester.

Method of Mixing.—The aggregate shall be thoroughly dried in properly designed driers before mixing with the bitumen. The driers shall be of the revolving type, thoroughly agitating and turning the materials during the process of drying. When the aggregate is thoroughly dried and heated to a temperature of from 200 to 350 degrees F., depending on the bituminous cement used, it shall be immediately, before cooling or exposing to moisture, mixed with the hot bituminous cement as hereinafter specified.

The bituminous cement shall be melted in a tank arranged so the heat can be properly and easily controlled and regulated. When melted and raised to a temperature of from 200 to 350 degrees F., depending on the bituminous cement used, it shall be combined in proper proportions with the hot aggregate and immediately mixed in a properly designed mixer with revolving blades until a thorough and intimate mixture of the ingredients has been accomplished, and the particles composing the aggregate evenly and thoroughly coated with the bituminous cement. The mixer shall not be exposed directly to the action of the fire.

Laying.—While still hot from the mixer, the paving mixture shall be spread evenly on the foundation with hot iron rakes or shovels or both, so that when compressed with the roller it shall have the thickness specified above, with the surface even and true to grade. Along the curb and around manholes, catchbasins and other obstructions in the street where the roller cannot reach, the compression shall be secured by the use of hot iron tampers. The tamping shall be done as quickly as possible after the material is spread, while still hot and pliable. When the paving mixture is hauled on the street in dump wagons it shall be kept covered with canvas to retain heat, dumped on platforms and shoveled into place and raked to secure the proper grade. As soon as the temperature will permit, the paving mixture shall be rolled with a tandem steam roller weighing at least five tons, and the rolling continued,

working lengthwise and diagonally of the street. Rolling must be steadily kept up and continue until all roller marks shall disappear, and the surface gives indication of no further compressibility.

The paving shall be done continuously, so the number of joints between the hot and cold material shall be reduced to the minimum. When it is not practicable to lay it continuously and a joint is unavoidable, the edge of the cold material shall be trimmed down to a rough feather edge, and the surface, where the joint is to be made, painted over with bituminous cement, the hot material raked over the feathered edge and thoroughly rolled. Instead of trimming the cold material, joint strips may be used, consisting of strips of canvas about 18 ins. wide with three parallel lines of ¾ in. ropes sewed on the under side about 3 ins. apart. The joint strips shall be laid on the feather edge of the freshly raked material, with the upper rope at the line where the thickness begins to decrease, and the rolling completed on top of the canvas as for finished pavement. The faces of the curb and gutter, iron castings, etc., shall be painted with the bituminous cement before the paving mixture is laid.

Surface Finish.—As soon as possible after the rolling of the mixture is finished, and while the surface is still fresh and clean, and if possible while warm, a skin coat of bituminous cement of proper consistency to be flexible when cold shall be spread over the surface. It shall be spread on while at a temperature of from 200 to 300 degrees F., depending on the bituminous cement used, and evenly spread with rubber squeegees. Only a sufficient coat shall be spread to flush the surface voids without leaving an excess. Immediately over this a top dressing of torpedo sand, fine gravel or stone chips free from dust, which must be thoroughly dry and heated in cold weather, shall be spread and thoroughly rolled into the surface. A small surplus shall be left to be worn in or worn away by the traffic.

After the sand or stone chips have worn into the surface, the street shall be swept, all excess of surfacing material removed, and the street left clean.

SPECIFICATIONS FOR CONCRETE SIDEWALKS, CURBS AND GUTTERS AND PAVEMENTS.*

CEMENT.

THE cement shall meet the requirements of the standard specifications for Portland cement of the American Society for Testing Materials (adopted August 16, 1909), with Section 21 amended to read as follows:

	Strength lbs. per sq. in. Neat.
24 hours in moist air	175
7 days (1 in moist air, 6 in water)	500
28 days (1 in moist air, 27 in water)	600

Provided, however, if the cement fails to meet the requirements of the 24-hour test, it may, at the discretion of the engineer, be held for further tests before being rejected, with the mixture of 1 cement to 3 standard Ottawa sand, and in no case shall the increase in strength at 28 days be less than 20 per cent. over the strength shown at 7 days.

CONCRETE FOR PAVING FOUNDATIONS.

1. Cement.—(As specified above.)

2. Fine Aggregate.—The fine aggregate shall consist of any material of siliceous, granitic or igneous origin, free from mica in excess of 5 per cent. and other impurities, uniformly graded, the particles ranging in size from ¼ in. to that which will pass a No. 100 standard sieve.

3. Coarse Aggregate.—The coarse aggregate shall be sound gravel, broken stone or slag, having a specific gravity of not less than 2.6. It shall be free from all foreign matter, uniformly graded, and shall range in size from ¼ in. up, the largest particles not to exceed in any dimension half the thickness of the concrete in place.

4. Proportions.—In preparing the concrete, the cement and aggregate shall be measured separately, and then mixed in such proportions that the resulting concrete shall contain fine aggregate amounting to half of the volume of the coarse aggregate; and that

*Report of committee of the Organization for Standardizing Paving Specifications.

7 cu. ft. of concrete in place will contain 94 lbs. of cement.

5.—Mixing.—The ingredients shall be thoroughly mixed, sufficient water being added to obtain the desired consistency, and the mixing continued until the materials are uniformly distributed, and each particle of the fine aggregate is thoroughly coated with cement, and each particle of the coarse aggregate is thoroughly coated with mortar.

Where a mechanical concrete mixer is used, the materials must be proportioned dry, and then deposited in the mixer all at the same time. The mixer must produce a concrete of uniform consistency and color, with the stones thoroughly mixed with the water, sand and cement.

6. Consistency.—The materials shall be mixed wet enough to produce a concrete of a consistency that will flush readily under light tamping, but which can be handled without causing a separation of the coarse aggregate from the mortar.

7. Re-tempering. — Re-tempering, that is, re-mixing with additional water, mortar or concrete that has partially hardened, will not be permitted.

8. Placing Concrete.—The concrete shall be deposited in a layer on the sub-grade in such quantities that, after being thoroughly rammed in place, it will be of the required thickness, and the upper surface shall be true, uniform and parallel with the surface of the finished pavement.

In conveying the concrete from the place of mixing to the place of deposit, the operation must be conducted in such a manner that no mortar will be lost, and the concrete must be so handled that the foundation will be of uniform composition throughout, showing no excess nor lack of mortar in any place.

9. Protection.—When complete, the foundation shall be kept moist for four days, and it shall be protected from traffic until the concrete has thoroughly set before the wearing surface is put on.

CONCRETE PAVEMENT.

Because of lack of experience with this form of pavement, we hesitate to recommend the adoption of specifications. This subject should be given further study. There are two or more concrete pavements now in use, on which patents have been obtained. We consider it outside of the jurisdiction of the committee to pass upon the merits of these pavements. If any municipality should desire to lay any of these patented pavements, specifications should be obtained from the patentee, but the materials used in the work should conform to the requirements of the standard specifications.

We believe that there are conditions where traffic is light, and economy and cost are essential considerations, where a concrete pavement may be used to advantage. In such cases we recommend for your consideration the following specifications:

[These specifications for concrete pavement are identical with the foregoing specifications for concrete foundation, with exceptions as follows:

(A) The coarse aggregate is to be "sound broken stone, trap rock, or granite, having a specific gravity not less than 2.6," etc.

(B) The proportions to be such that 5 cu. ft. of concrete (instead of 7 cu. ft.) will contain 94 lbs. of cement.

There are also the following additional paragraphs:

9. Finishing.—The pavement shall be finished by thorough hand-tamping until the mortar flushes freely to the surface, then lightly tamped with a templet made of 2-in. plank shaped to conform to the curvature of the surface of the finished pavement and having a length of not less than half the width of the roadway to give a uniform surface, with the slight markings thus made transverse to the street.

10. Expansion Joints. — Expansion joints shall be placed at right angles to the curb line at intervals of 50 ft. These joints shall be not less than 1 in. wide, and shall be filled with creosoted soft wood timber with the grain vertical and extending full depth of the pavement.

11. Protection to Work.—During the first four days after placing, the pavement shall be kept moist, and it shall be protected against traffic until the concrete has thoroughly set. In no event shall the pavement be used within ten days after being laid.

CONCRETE SIDEWALK.

[These are identical with the specifications for concrete foundation, except for the paragraphs given herewith.]

Coarse Aggregate.—The coarse aggregate shall be sound gravel, broken stone or slag, having a specific gravity of not less than 2.6. It shall be free from all foreign matter, uniformly graded, and of sizes that will pass a 1-in. screen and be retained on a 1¼-in. screen.

Water.—The water used in mixing the concrete shall be clean, free from

oil, acid, strong alkalis or vegetable matter.

Base Proportions.—In preparing the concrete for the base, the cement and aggregate shall be measured separately, and thenmixed in such proportions that the resulting concrete shall contain fine aggregate amounting to half of the volume of the coarse aggregate; and that 5½ cu. ft. of concrete in place will contain 94 lbs. of cement.

Consistency.—The materials shall be mixed to produce a concrete of such consistency that the water will flush to the surface under heavy tamping.

Forms.—The forms shall be smooth, free from warp, of sufficient strength to resist springing out of shape, and of a depth to conform to the thickness of the proposed walk. All mortar and dirt shall be removed from forms that have been previously used.

The forms shall be well staked and set to the established lines, their upper edges conforming to the grade of the finished walk, which shall have sufficient fall from the lot line towards the curb line to provide for drainage, but shall not exceed ⅜ in. per ft.

The base shall be blocked out in sections, which shall not measure more than 6 ft. in any dimension.

The cross forms shall be of ¼in. metal, of a depth to correspond to the thickness of the proposed walk, and shall extend full width of the walk and be set at right angles to the side forms. They shall be left in place until the wearing surface is floated.

Wearing Surface.—The wearing surface shall be composed of 1 part Portland cement and 2 parts fine aggregate, mixed with sufficient water to produce a mortar of a consistency which can be easily spread into position with a straight edge. The mortar shall be mixed in a mortar box and spread on the base immediately after mixing. In no case shall the wearing surface be placed after the base has set.

After the wearing surface has been worked to an approximately true plane the slab marking shall be made directly over the joint in the base. Such marking shall be made with a tool which will cut entirely through and completely separate the surface of adjacent slabs.

Edges.—The slabs shall be rounded on all surface edges to a radius of about ½ in.

Troweling.—The surface shall be troweled smooth. The application of neat cement to the surface in order to hasten hardening is prohibited.

Protection.—When completed the walk shall be kept moist and protected from traffic and the elements for at least three days.

CONCRETE CURB AND GUTTER.

These specifications are practically identical with those for concrete walks, except as to the fine aggregate and the requirement that the work must be kept moist for four days and protected for at least ten days. The two exceptional paragraphs are as follows:

Fine Aggregate.—The fine aggregate shall consist of any material of siliceous, granitic or igneous origin, free from mica in excess of 5 per cent., and other impurities, and shall be graded sizes ranging from ⅛ in. down to that which will be retained on a No. 80 standard sieve for the top wearing surface; and from ¼ in. down to that which will pass a No. 100 standard sieve for the base.

Curb and Gutter Not Built in Place.—Where built at a point removed from the work, they shall be constructed in the same manner and of the same materials as above specified, and shall be allowed to harden for at least ten days before being transported to their position in the work. The length of any section shall be not less than 4 ft. nor more than 6 ft.

SPECIFICATIONS FOR CREOSOTED WOOD BLOCK PAVEMENT.*

YOUR committee that was appointed for the purpose of drafting standard specifications for creosoted wooden block pavement has had three separate sessions of one-half day each, at which all members of the committee were present except Mr. MacVicar, of Des Moines, who was called out of town. His place, however, was acceptably filled by Mr. J. K. Mitchell, of Detroit. The committee has called in consultation all of

*Report of committee of the Organization for Standardizing Paving Specifications.

the manufacturers of wood block pavement that it was possible to reach, four companies being represented before the committee, and another one informally with the chairman. The committee has discussed the question in every phase, and after giving careful consideration to the statements of all of the manufacturers, it has decided to recommend the following as the principles upon which specifications shall be drafted, the idea being that these principles would be sufficient to enable any manufacturer to make a block that would conform to the specifications and at the same time permit the local engineer to adapt same to conditions in his particular city. The conclusions which were reached are as follows:

TIMBER.

The wood to be treated shall consist of long leaf yellow pine, Norway pine, black gum and tamarack, only one kind of wood, however, to be used in any one contract.

Yellow pine blocks shall be cut from what is known as prime timber, namely, all timber must be sound, commercial long leaf yellow pine, well manufactured, full size, saw-butted, all square edge, and shall be free from the following defects: Unsound, loose and hollow knots, worm holes and knot holes, through shakes and round shakes that show on the surface. In yellow pine timber the annual rings shall average not less than six to the inch measured radially from the center of the heart.

Norway pine block, gum and tamarack blocks shall be cut from timber that is first class in every respect, and shall be of the same grade as that defined for the yellow pine.

SIZE OF BLOCKS.

The blocks shall be from five to ten inches long, but shall average eight inches; they shall be three and one-half (3½) and four (4) inches in depth, according to traffic; they shall be from three (3) to four (4) inches in width, but all blocks in one street or improvement shall be of uniform width, provided that blocks three (3) inches in depth can be used on residential streets and in alleys; provided further that in no case shall the width and depth of the blocks be the same.

A variation of 1-16 of an inch shall be allowed in the depth and ⅛ of an inch in the width of the blocks.

TREATMENT.

The blocks shall be treated with a preservative oil elsewhere described, so that the pine and tamarack blocks shall contain not less than twenty (20) and the gum blocks not less than twenty-two (22) pounds per cubic foot.

OIL.

The oil used shall be a coal tar product, free from adulteration of any kind whatever, and shall comply with the following requirements:

1. The specific gravity shall be at least 1.10 at a temperature of 38 degrees C.

2. Not more than three (3) per cent. of the oil shall be insoluble by hot continuous extraction with benzol and chloroform.

3. On distillation, which shall be made exactly as described in Bulletin No. 65 of the American Railway Engineering and Maintenance of Way Association, the distillate shall not exceed two (2) per cent. up to 150 degrees C. and 35 per cent. up to 315 degrees C. The mean of three determinations to be taken.

The manufacturer of the oil shall permit full and complete inspection and sampling at the factory at which the oil is produced, of all materials, either crude or refined, entering into the manufacture of the finished product, as well as the finished product itself, in order that the materials used can be determined to be in accordance with the foregoing requirements. He shall also submit satisfactory proof of the origin of all materials entering into the composition of the finished product.

Oil samples taken by the inspector from the treating tank during progress of the work shall at no time be allowed to show an accumulation of more than two per cent of foreign matter, such as sawdust and dirt.

Due allowance shall be made for such accumulation of foreign matter by injecting an additional quantity of oil into the blocks.

CUSHION.

The blocks shall be laid on a sand cushion, one inch in thickness, placed upon the concrete foundation.

FILLER.

The joints between the blocks shall be filled with pitch or fine sand, the particular kind to be determined by the local authorities, as conditions may demand.

EXPANSION JOINTS.

An expansion joint shall be laid along the curb, and transverse joints one-half inch in width every fifty feet along the street, these joints to be filled with a bituminous composition,

the necessity of the transverse joints to be determined by the local authorities, according to climatic conditions.

INSPECTION.

The party manufacturing the blocks shall equip his plant with all the necessary gauges, appliances and facilities to enable the inspector to satisfy himself that the requirements of the specifications are fulfilled.

The committee feels that, while the above specifications are not perfect, by any means, they do represent the judgment of the committee, after a full and careful consideration of the matter in all its details.

The committee wishes to thank the representatives of the different manufacturers for the valuable information furnished the committee, all of which is respectfully submitted.

SEWAGE PURIFICATION FOR THE CITY OF DRESDEN, GERMANY.

By Dr. Robert Grimshaw, Dresden, Germany.

THE works in the Kaditz meadows for purifying and pumping the sewage of the city of Dresden are rapidly approaching completion, by reason of the favorable weather conditions, so that the station can be started some time in 1910. About two and a half years ago the work of digging out was commenced, for the purifying reservoir, about 80 meters long, 30 wide and on the average 10 deep, together with the sewers which discharge into this, and the channels for the discharge of the water therefrom.

This plant has for its object to purify the entire sewage of the city of Dresden from all floating impurities over 2mm (say 0.078 inch) in diameter, before it is discharged into the river Elbe. The foul water is discharged into the reservoir by the two great collecting sewers. One of these, on the Neustadt side, runs in its course from the Albert Bridge to Old Mickten, about parallel to the Elbe; and from the suburb named, along Scharfenberger street. This sewer receives all the foul water on the Neustadt side of the city. The other, on the Altstadt side, begins at Schubert street in the suburb of Striesen, and follows the river to a point below the Marien Bridge. Here it diverges, runs along Magdeburg street, crosses the Elbe by means of a syphon above the mouth of the Weisseritz stream (that did so much damage in 1897), and passes through Neustadt territory. Here it passes through the Uebigau and Kaditz meadows (in the district in which will be laid the Hochufer or High Bank street), and joins the Neustadt collecting sewer under Scharfenberger street, carrying the entire volume of sewage to the Altstadt, or "old city," side (so called because this is the newer portion of the city!).

After joining, the two collecting sewers deliver the sewage for the first purification, in which, by means of floating beams, iron gratings, etc., the larger floating impurities are kept back. The purification proper takes place in the immense purification plant. In this there are four great separating disks of the Reinsch system, each eight meters in diameter. These are furnished with innumerable slots only 2 mm wide, through which the sewage seeps, and which retain all the undissolved particles over 2 mm diameter. These disks are kept in constant slow motion, and the impurities are automatically removed by brushes and dredged out into cars ready to take them where they are to be used as fertilizers. At first, however, they are stored in a place specially reserved therefor.

The purified water flows in dry weather, or when there is only slight rainfall, through the outlet channel, and is discharged into the Elbe at the middle of its width. If by reason of heavy rains the discharge is abnormally great—say, more than three cubic meters or about 100 cubic feet, per second—then the two rain channels are used, which discharge on the right bank of the Elbe, opposite the steamboat station, Briesnitz-Kemnitz.

If by reason of the rise of the Elbe (which in spring sometimes reaches 14 feet above the so-called "zero" point, that in itself is four meters or about 13 feet above the dredged out steamer channel), the gate valves are closed, and the sewage is pumped into the Elbe direct. The pumping station is about 60 meters long, 20 wide and

10.5 deep. The cement work for the purification plant was ready long ago, that of the pumping station is not yet completed.

The combined earth work and cement work has been done by the Dresden firm of Dykerhoff & Widamann, according to the plans and specifications, and under the direction of the Tiefbauamt or Underground Commission of the city of Dresden. The work of keeping all dry in the deep basins and channels has at times required the work of seven locomobiles, of which at present only two are at work. This work is done by the Tiefbauamt, which also has charge of the various streets and squares in the district in question.

THE COMBINED ELECTRIC LIGHT AND WATER WORKS OF THOMASVILLE, GA.

By Frank C. Perkins, Buffalo, N. Y.

THE light plant at Thomasville, Ga., is operated by the municipality in connection with the waterworks pumping plant.

The electric and engine equipment consists of two generators of 200 kilowatts and 250 kilowatts capacity, belted to Corliss engines. One unit has been operating for three years, and generates current, it is maintained, at slightly over one cent per kilowatt hour, with coal as a fuel at $3.20 per ton.

The street lighting of the city of Thomasville includes 70 enclosed arc lamps of 1,200 candle power, and 50 tungsten lamps of 50 watts each, while the commercial lighting is all operated on the meter system and consists of 10,000 incandescent lamps of 8 or 16 candle-power each.

The boiler room for the combined electric light plant and waterworks is provided with four return tubular boilers, 66x16 with a rated horse-power of 100 each, and all equipped with shaking grates for hand firing. The service has not been interrupted from any cause whatever during the past three years. It is stated by J. A. Epply, superintendent of the waterworks and motive power for the city of Thomasville that the plant is earning some money selling current for 10 cents per kilowatt hour, besides saving the city about $5,000.00 per year for street lighting, over the rate previously paid.

It is maintained that the plant is operated on the eight-hour system as most economical, it not being possible to get the desired results when working men twelve hours every day in the year at the combined lighting and pumping station.

The plant is in charge of a committee of three members of the City Council, appointed by the mayor, and the superintendents are elected by the City Council, every one being hired on the merit system. The electrical equipment is under the charge of Supt. D. E. Pringle.

A COMPARISON OF COST AND EFFICIENCY OF METHODS OF STREET LIGHTING.

By N. R. Birge, Schenectady, N. Y.

IN view of the thousands of dollars annually spent in our cities for public improvements, it is surprising to note in how many instances the public lighting is left to remain as it was a decade ago. These antiquated methods of illumination are not only unprofitable to the stations operating them, but fail to give the public the benefit of the advantages to be derived from the more modern illuminants. When arranged in accordance with present day practice, the later lighting equipments not only provide for the quantity and quality of the illuminants required, but for their esthetic arrangement as well.

In considering the most desirable method of illumination, one must be governed by local conditions, as the

amount of illumination required varies in accordance with the locality. For districts requiring a high degree of illumination, the arc lamp is best adapted. On the other hand, there are districts where the volume of light from the arc is more than is required, or more than can be used effectively, as, for example, where the presence of dense foliage confines the illumination from any one source to a very restricted area. For such localities the series incandescent lamp can be used to advantage. With a combination of arc and incandescent lights the esthetic results are not only enhanced, but an increase in revenue to the operating station is realized. Many incandescent lamps will therefore be added to the circuits of the lighting company in districts that have formerly been left in total darkness on account of the lack of satisfactory and inexpensive units of low illuminating intensity.

In the early days of arc lighting the open carbon arc was such a pronounced improvement over the illuminants then in general use that the details of cost and maintenance were not seriously considered. The advent of the enclosed arc lamp, however, opened up a new field, and since the days of its introduction there has been a steady improvement in its mechanical construction and the quantity and quality of its illumination, with a resulting economy in operation.

In endeavoring to further increase the illuminating efficiency of the arc lamp, at the same time maintaining its simplicity of construction, it became necessary to abandon the use of carbon electrodes for those composed of other substances. This resulted in the adoption and perfection of the "magnetite," or "luminous arc," as most suitable to meet present requirements.

When designing the mechanism of the luminous arc lamp, the most important details to be considered were the method of feeding the electrodes, and their relative positions. Naturally, the first step towards perfecting these important details embodied methods most commonly employed in connection with the carbon arc: viz, a clutch mechanism acting directly upon a composition electrode arranged to feed in a downward direction.

On account of the peculiar characteristics of the arc, this method introduced complications of such a serious nature that it was abandoned for a simpler construction, which not only overcomes the mechanical difficulties formerly encountered, but embraces the advantages derived from the ideal distribution of light rays from the arc. The design has been perfected to such a high degree that more than 25,000 luminous arc lamps are now in successful commercial operation, with results most gratifying to both the general public and the operating stations.

The luminous lamp commends itself to operating managers for the following reasons:

First. The lamp consumes only 310 watts and gives 30 per cent more effective illumination than is secured with a 480 watt carbon lamp.

Second. Electrodes have a life of 175 to 200 hours; consequently, the cost of trimming is lower.

Third. No enclosing globes are required, thus eliminating this item of maintenance..

Fourth. Ideal distribution of light due to the permanent position and character of the arc.

The proper wattage consistent with suitable illumination, with due respect to low operating and maintenance expense, was determined from actual experience, and a current consumption of 4.0 amperes and an arc voltage of 75 was decided upon. A higher or lower adjustment, however, can readily be made, either at the operating station or at the place of manufacture.

Although designed primarily for operation on 4 ampere direct current circuits, the luminous arc lamp can be operated with equal success from an alternating current source by means of a motor generator set or a suitable current rectifier.

The motor generator set, consisting of an alternating current motor driving a direct current series arc machine, is familiar to all operating engineers.

The current rectifier, commonly designated as the series mercury arc rectifier, includes a constant current transformer, series mercury arc rectifier tube, tank for tube, transformer for exciting rectifier tube, and switchboard.

The constant current transformer used with this outfit has the same characteristics as the one used with the well-known series alternating arc systems. The primary windings are connected to a constant potential alternating current supply of any commercial voltage or frequency. The secondary windings are connected to the anodes, or alternating current terminals of the rectifier tube. A tap in the middle of the secondary winding connects the transformer and its direct

current reactance to the negative end of the lamp circuit; the positive end of the lamp circuit being connected through an ammeter to the cathode of the rectifier tube.

The adjustment for the proper current in the lighting circuit is obtained by changing the weights attached to the rocker arm which supports the movable coil of the transformer.

The rectifier tube, by means of which the alternating current is transformed into direct current, consists of an exhausted glass vessel, enclosed in a steel tank filled with oil; the oil being maintained at the proper temperature by means of water cooling coils.

The exciting transformer is used to supply a low potential current to the starting anodes and cathode of the rectifier tube.

The standard series rectifier switchboard consists of blue Vermont marble supported on a pipe frame, the bottom of the panel being above the floor level. The equipment consists of the necessary instruments and switches for the control of the circuit.

Until recently, low frequency alternating current circuits (25 to 30 cycles), without motor generator or frequency changing sets, have been used very little for arc lighting purposes.

However, the rectifier set, which fulfills the purpose of the motor-generator, can be operated at these low frequencies. The first cost of the rectifier set is much lower than that of a motor-generator or frequency changer, the efficiency is higher, and less floor space is required.

The following is a comparison showing the costs of operating a one hundred light open arc system and a one hundred light series luminous arc rectifier system. In making this comparison three distinct problems are considered:

First. Interest and depreciation on the investment.

Second. Maintenance, including cost of electrode renewals, trimming and repairs.

Third. Cost of energy consumed.

INTEREST AND DEPRECIATION ACCOUNT.

Approximate scrap value of 100-light, 9.6 ampere A.C. Open Arc System, including belt driven arc machine, lamps and cutouts	$600.00	
Cost of 100-light Luminous Arc Rectifier System, complete with lamps, cutouts, etc., and including generator capacity..		$5,700.00
Interest and depreciation at 12 per cent. per annum.....	72.00	684.00

The cost of the distributing lines has been omitted, as this would be the same for either system.

MAINTENANCE.

Trimming—		
Open arcs are trimmed every day. One man at $50 per month can trim 100 lamps per day, making cost per lamp per year.....	$6.00	
Luminous arcs are trimmed about 23 times per year of about 4,000 hours. One hundred lamps would require about one-sixth of a man's time, making cost per lamp per year...		$1.00
Carbons and Electrodes—		
Open arcs require two carbons per day, or 730 per year, at a cost of $7.50 per 1,000. Cost per lamp per year.....	5.50	
The luminous arcs require trimming of the lower electrode every 175 to 200 hours, or 23 times per year; the upper electrode every 4,000 to 6,000 hours. Cost of lower electrodes, 5 cents each, and upper electrodes, 55 cents each, making the cost per lamp per year.....		1.70
Outer Globes—		
A fair allowance would be 30 cents per lamp per year for the open arcs, and 50 cents per lamp per year for the luminous arcs	.30	.50
Repairs—		
This item is difficult to determine on account of varying local conditions, but a conservative estimate based on an average figure would be	2.50	.75
Tube Renewals—		
Cost of tube renewals, based on average		

central station reports, would not be more per lamp per year than.....		3.00
Total maintenance charge per lamp per year	14.30	6.95
Total for 100 lamps...	$1,430.00	$695.00

COST OF ENERGY.

The line loss in each installation will depend on the length of line, but for the purpose of comparison a loss of 10 per cent. at 9.6 amperes is taken as a representative case. Assuming the size of wire to be the same for both systems, the relative losses will be proportionate to the square of the current.

Watts consumed at terminals...	480 watts	310 watts
With a line loss of 10 per cent. and a generator efficiency of 64 per cent., each 9.6 ampere open arc lamp requires 835 watts at the engine shaft, or a total for the system of.....	83,500 watts	
With a line loss of 2 per cent. and a generator and transformer efficiency of 83 per cent., each 4 ampere luminous arc lamp requires 380 watts at the engine shaft, or a total for the system of..		38,000 watts
Burning 4,000 hours per year, with the cost of energy at 1½ cent per kilowatt hour, the cost per lamp per year would be.....	$50.10	$22.80
Total for the system	$5,010.00	$2,280.00

SUMMARY.

Interest and depreciation	$72.00	$684.00
Maintenance	1,430.00	695.00
Energy	5,010.00	2,280.00
Total for 100-light system...	$6,512.00	$3,659.00

This shows an annual saving in favor of the luminous arc rectifier system of $28.53 per lamp, or a total saving per year of $2,853.

Therefore, the total net investment of $5,700 for the luminous arc rectifier system will be paid for in about two years, after which the net annual saving will create a dividend of more than 50 per cent. on the new investment.

Parallel with the improvement of series arc lamp efficiency, rapid progress was made in the development of the series incandescent lamp. The first series incandescent lamps were placed in service in 1880, and were operated in series with open arcs supplied from arc dynamos, but these incandescents were crude, inefficient and short lived.

It was about fifteen years later that the manufacturers realized that to improve the operation of these lamps and produce a satisfactory system for street lighting the developing of a suitable regulating device was essential. During this period the bank board system was first introduced. This was followed by the shunt box method of regulation, and still later by the reactive coil; but it was not until 1902 that the constant current transformer was commercially introduced as a means of regulation.

The advantages of the constant current transformer over other methods of regulation are:

First. The absence of a grounded secondary or circuit line.

Second. Since the life of the lamp depends largely on the regulation of the lighting system, the close regulation of the constant current transformer reduces lamp renewals to a minimum.

Third. The constant current transformer, which combines the step-up transformer and reactive coil, avoids the necessity of two separate pieces of apparatus and reduces the amount of floor space required.

Some of the old systems mentioned still occasionally enter into competition with the constant current transformer because of a slightly lower initial cost of installation. They lack, however, many of the essential features necessary for an efficient installation, the most important of these being close regulation. Past experience has proved that with each improvement in regulating apparatus a corresponding improvement in the life of the incandescent lamps has resulted.

The first series incandescent lamps were of an efficiency of about 5 watts

per candle. Improvements in lamp manufacture produced a 4 watts per candle lamp, and later a 3.5 watts per candle lamp giving better life results; and only a few years ago the GEM metallized filament lamp was introduced, with an efficiency of 2.7 watts per candle. The introduction of the tungsten lamp has been the latest step in advance, giving us a lamp of 1¼ watts per candle, which efficiency is maintained practically constant throughout a life of from twelve hundred to fifteen hundred hours.

The following is a comparison showing the cost of operating one hundred 40-candle-power carbon filament, GEM filament, and tungsten incandescent lamps:

COST OF ENERGY.

The carbon filament lamps are assumed to have an efficiency of 3½ watts per candle-power; the GEM filament lamps, 2.7 watts per candle-power, and the tungsten lamps, 1¼ watts per candle-power. Assuming that the lamps burn 4,000 hours per year, and that the energy costs 1½ cents per kilowatt hour, the cost for 100 lamps would be:

Carbon filament lamp	$840.00
Gem filament lamp	648.00
Tungsten lamp	300.00

(These figures do not include loss in transformer or generator.)

COST OF RENEWALS.

Number of renewals	4	4	3
Price of lamp	$ 0.493	$ 0.553	$ 1.215
Cost of renewals per 100 lamps	197.20	221.00	364.50

The total cost of 100 lamps, including energy and renewals, would be:

Carbon filament lamp	$1,037.20
Gem filament lamp	869.00
Tungsten lamp	664.50

The saving in favor of the tungsten lamp would therefore be:

Tungsten over Gem—
$204.50, or $2.05 per lamp per year
Tungsten over Carbon—
372.00, or 3.73 per lamp per year

The station equipment for any series incandescent system may be a part of the series arc lighting outfit previously described, with the lamps in series with the luminous arc lamps; or it may be entirely separate. The former arrangement is generally the one employed in large towns and cities where both arcs and incandescents are used, and the latter in smaller places where only the incandescents are required.

For installations consisting entirely of incandescent units, the constant current transformer has been standardized for a primary voltage of 1,100 or 2,200 volts, and frequencies of from 60 to 125 cycles, in capacities of 4, 8, 16, 22 and 32 kilowatts. Special transformers, however, can be built for almost any primary voltage, frequency or kilowatt output. The standard secondary or line current adjustments are for 3.5, 4, 5.5 and 6.6 amperes, although 1.75 and 7.5 ampere transformer can be furnished if desired.

Tungsten lamps have been designed for 25, 32, 40 and 60 candle-power, for standard current adjustments. In addition, higher candle-power lamps are being developed, and may possibly be had in the near future, in sizes of 80, 100 and 200 candle-power.

Various arrangements for the suspension of these small units have been perfected, the latest and most popular of which is the ornamental bracket fitted with a radial reflector. This reflector serves the double function of protecting the lamp and of directing the rays in the most efficient direction, thus increasing the effective illumination about 20 per cent. The brackets are mounted on poles placed on alternate sides of the street at equal distances apart, and so arranged that the lamp is suspended about four feet out from the curb. The proper height of the suspension depends on the intrinsic brilliancy of the illuminating unit, the distance between the poles, and the necessity of minimizing the shadows from foliage. In determining the height, care should be used to suspend the unit so that the rays of light will not shine directly in the eyes of persons approaching, but not so high that the foliage will intercept the rays.

Although the effect of gas illumination with Welsbach mantles is, under ideal conditions, similar to the incandescent unit of small illuminating intensity, the esthetic effect is less impressive. The wide variation in candle-power during the life of the mantle is also objectionable, while the cost of operation is in favor of the series incandescent system. For these and other reasons of less importance, the use of gas for street illuminating purposes is being rapidly replaced by the more modern system of series incandescent lighting.

The following table, compiled from results obtained from actual tests, serves to show the wide variation of candle-power during the life of a Welsbach mantle:

City	Maximum Candle-Power	Minimum Candle-Power	Average Candle Power
(1)	55.0	21.5	36.7
(2)	25.0	6.5	16.8
(3)	55.1	16.3	27.8

In making a suitable comparison of the operating costs of the Welsbach mantle and tungsten lamp, it will be necessary to take the 60 c.p. tungsten lamp, as the Welsbach mantles are rated at 60 c.p. Basing the comparison on 4,000 hours yearly burning, and allowing three renewals per year for tungsten lamp, the following results are secured:

One 60 c.p. tungsten lamp consumes 75 watts, and when operating 4,000 hours per year, requires 300 kw. hours.
300 kw. hours, at 1½ cents per kw. hour $4.50
Three renewals at $1,215 each.... 3.65

Total cost per lamp per year...$8.15
One 60 c.p. Welsbach mantle consumes 3½ cubic ft. of gas per hour, and when operating 4,000 hours per year, requires 14,000 cu. ft.
14,000 cu. ft. at $.75 per 1,000 cu. ft. $10.50
Maintenance at 3 cents per night (365 nights)..... 10.95

Total cost per year.....$21.45
Net saving in favor of the tungsten lamp.....$13.30

At 50 cents per 1,000 ft. for gas, a saving of $9.80 is shown in favor of the tungsten lamp.

Special emphasis should be laid on the fact that the candle-power of the tungsten lamp is practically the same throughout its life, while the gas mantle loses about 25 per cent. of its initial candle-power in the first 100 hours, and at the end of 1,000 hours is furnishing only 25 or 30 per cent. of its rated candle-power.

It is evident from what has been said that electric light is the most economical form of street illumination; that the luminous arc is the best lighting unit for general city street lighting; and that the series tungsten incandescent is most satisfactory for suburban lighting and lighting in other localities where conditions demand a unit of minor intensity.—*General Electric Review.*

THE ARTESIAN WELLS OF THE WATER SUPPLY OF MEMPHIS, TENN.

THE city of Memphis, Tenn., has a unique system of water supply which is very satisfactory under the local conditions, but those conditions are so peculiar that it will seldom be possible to apply the same principles in other cities.

The beginning of the system was by accident, a manufacturing concern putting down a well to obtain water for condensing purposes striking a stratum of water with head enough to produce a flowing well. This occurred in 1887. Prior to that time, beginning as early as 1870, attempts had been made with little success to procure satisfactory water from surface sources, most of the reports on the subject casting doubt on the practicability of well water for a city system.

On the discovery of the artesian well the Artesian Water Company was formed and shortly consolidated with the Memphis Water Company, which had been struggling with a surface water supply.

One well not being sufficient, others were driven, and, these wells relieving the pressure on the underground supply, the wells ceased to flow at the surface, but continued to flow at a greater depth. These facts resulted in the construction of an underground reservoir in the form of a tunnel, into which the wells discharge, and from which the pumps raise the water. As the capacity of the works increases parallel with the demand, the number of wells must be increased, until ultimately the resulting reduction in the head on the underground reservoir reduces the flow so that the curves of consumption of water and capacity of wells intersect. The location of the underground tunnel reservoir is evidently very important, for if it is near the surface of the ground the capacity of the system will be reached more quickly than if it is deeper. But depth means expense in construction and operation.

The original pumping station is located in the northern part of the city, and there are now about 65 wells connected with the tunnel, which is 5 feet in diameter, about a mile long, and

from 70 to 95 feet below the surface of the streets under which it is located. The tunnel has a variable fall toward the pumping station of about 0.1 foot in 100 feet. The wells are connected with this tunnel through a total length of about 5½ miles of wood-lined drifts, each about 30 by 41 inches, which can be shut off from the tunnel. The wells are driven from the surface about 300 feet down through an impervious stratum of blue clay, and there reach a bed of fine sand about 150 feet thick. Several wells are over 500 feet deep, and one is over 600 feet. A second stratum of coarse sand is found at about 550 feet depth. At the beginning 43 wells were driven, all of which are now out of service. In all 159 wells have been put down, of which about 70 are now active, including 5 at the new east end station.

The standard construction of a well is first to drive a 13-inch pipe into the blue clay until the level of the tunnel is passed, thus casing off all water which may come from above. A 10-inch pipe is then driven inside this 13-inch pipe until it reaches the water-bearing stratum. The strainer running into the sand stratum is 50 feet long. The 10-inch pipe is connected with one of the drifts in the tunnel, which can be shut off so that the well can be isolated while being cleaned or when it is abandoned.

A good new well has a capacity of 800,000 to 1,000,000 gallons a day. Its capacity drops to about 500,000 gallons during the first 18 months, and then gradually declines to zero. There are several methods of cleaning wells and increasing their capacity.

1. Water at city pressure is turned into it, and is forced out through the strainer slits, opening up the sand to some extent. This method of cleaning will work for say two years.

2. Mr. Carl E. Davis, the resident engineer of the plant, to whom we are indebted for the information regarding methods of operation, has devised a special tool which restricts the application of the back water pressure to one foot of the strainer at a time, and the tool is gradually moved from one end to the other of the strainer. This method adds about another year to the life of a well.

3. The strainer may be removed entirely and the well washed out by water pressure, the strainer being then returned to the well.

4. The well is telescoped deeper in the sand, so that another part of the layer is put in use. As the sand layer is 150 feet deep and the strainer is 50 feet long, this can be done more than once.

5. When these methods all fail, a new well is driven. One driven 22 feet from the old well is as good as the original well.

Five or six years is the ordinary life of a well, and it will yield from 50,000 to 75,000 gallons a day for several years more. One well yielded 250,000 gallons a day for 15 years, and then stopped rather suddenly.

The study of the capacity of the wells is very fascinating. It depends on a number of variable quantities. Datum is 70 feet above the bottom of the tunnel at the pump well. The level of water in the wells fluctuates between points 5 feet above and 9 feet below the datum, due to the variations in pressure in the water-bearing sand stratum. The pumps draw down the water in the pump well in the day time 40 to 48 feet below datum as a minimum, and about 60 feet as a maximum. They draw the water down say 26 feet at night. The maximum is getting quite close to the top of the tunnel, which at its highest point is less than 65 feet below datum.

Capacities of wells are estimated at present for a draft on the pump well of 50 feet below datum. Each month a meter is dropped into each well and the flow is measured. The rate of flow shown by the meter at the accompanying draft is reduced to 50 feet draft and compared with the flow for the previous month. Accounts are kept with all the wells. Following is the record of one representative well:

December 29, 1908.....263,000 gallons
January 26, 1909.....227,000 gallons
February 26, 1909.....252,000 gallons
March 30, 1909.....208,000 gallons
April 27, 1909.....194,000 gallons

Well overhauled:

May 28, 1909.....495,000 gallons
June 30, 1909.....490,000 gallons
July 27, 1909.....420,000 gallons
August 31, 1909.....229,000 gallons
September 28, 1909.....165,000 gallons

Other wells when overhauled were increased in capacity 116,000 and 220,000, and one flushed with the special tool was increased 113,000 gallons.

A well which was discharging 82,000 gallons June 30 was telescoped to greater depth and discharged at the rate of 820,000 gallons a day on August 31.

Occasionally the tool-flushing results in a reduction in the flow in a well. Seven of the 57 wells tool-flushed in 1908 had this result, although the net increase in flow in the 57 wells was

5,379,000 gallons. The changes in flow ranged from a loss of 30,000 gallons in each of two wells to an increase of 440,000 gallons in one. Fifteen wells were overhauled in 1908 with an increase in flow of 1,717,000 gallons, the increases in the wells ranging from 27,000 to 261,000 gallons. Eleven wells were telescoped with a resulting increase in capacity of 5,528,000 gallons, the increase per well ranging from 50,000 gallons to 828,000, the latter being one of five which were not discharging any water prior to the telescoping.

Mr. Davis is making a study of the wells in groups, having divided them into four sections.

The present pumpage of water at this station is about 11,000,000 gallons a day. The pumps could draw for a few hours at the rate of 17,000,000 or 18,000,000 gallons a day.

On account of the growth of the city to the east and south, extensions of pumping capacity are made at two new stations. One at the east end now has five wells with a total capacity of 7,500,000 gallons a day. One of these is a 13-inch well, driven in 1908, which has a capacity of 3,000,000 gallons a day. The success with this well has been so great that it is now proposed to sink nearly all new wells of this size. Only this one well was added to the system in 1908.

The water at this station is raised by compressed air and the wells are 1,000 feet apart to prevent interference of one well with another. The wells are located in the streets where standpipes would be objectionable, and the tops of wells and station are on almost the same level. A unique device is provided for escape of air. It consists of a trap in the form of a tank 8 feet in diameter and 6 feet high, placed on top of the well and under the surface of the street. The 10-inch well projects up into this tank and the 8-inch discharge pipe also, but to a less height. The 2½-inch pipe carrying the air for the air-lift enters the tank and drops down the 10-inch well, lifts the water up into the tank and forces it out through the 8-inch discharge pipe to the collecting main in the collecting basin at the pumping station. Out of one side of the tank, near the top, comes an air pipe, which discharges in a vault at the sidewalk level. This pipe has a relief valve which is weighted so that the pressure of the air in the tank will be sufficient to force the water to the pumping station, and permits the excess of air after this pressure is reached to escape into the atmosphere. The water reaches the collecting basin entirely free from air, and the loss in efficiency is small. This station has five 1,000,000-gallon pumps and one 2,000,000-gallon pump, and pumps about 1,250,000 gallons a day.

Another branch at South Memphis has two small pumping stations of 4,000,000 gallons total capacity and pumping about 600,000 gallons a day.

It should be noted that the city of Memphis purchased the water works system in 1903.

LOWERING WATER LEVEL IN WELLS OF FRANKFORT, IND.*

By J. B. Marvin, Engineer and Superintendent of Frankfort Water Works Company.

AT certain low levels in and around Frankfort the water flowed as late as 1890. It was observed, however, prior to that date the head of the ground water was gradually receding. My concern was rendered acute on the water supply question, made so by having in charge the management of the waterworks at Frankfort during these years.

The water supply is obtained from a coarse gravel and sand stratum reached at a depth of fifty feet at the point where the waterworks are located near the center of Frankfort, and continuing to a depth of eighty feet, thus giving thirty feet of most excellent water-producing gravel and sand. Immediately above this stratum lies twenty feet of blue impervious clay; below is found a greater thickness of the same kind of clay. These conditions prevail throughout a large area of our section, the water-bearing stratum varying somewhat in thickness. From this it would appear that the supply of water in this locality was reasonably well assured. However, I

*A paper before the Indiana Sanitary and Water Supply Association.

have no theory to exploit, either scientific or theoretical, as to the ultimate permanency of the supply, nevertheless I have a decided opinion. I know that by 1892 the head of the water had fallen to a depth where it was necessary to use artificial means to aid the flow.

At this period of the declining ground water level, compressed air was employed to accelerate the flow of the water, and the same was used with varying degrees of success until 1907, and abandoned at that time on account of the ineffectiveness of the method and in consequence of the excessive cost, but most of all, the never ending trouble caused by an offensive odor and disagreeable taste in the water. Be it here understood that at no time prior to the using of air was there even a suggestion of trouble from algae, and it entirely disappeared with the discontinuance of the use of air. During the period air was used our storage consisted of two reservoirs of brick construction, puddled on the outside with blue impervious clay and water-proofed within; bottoms made secure, both reservoirs covered and never neglected in the point of being regularly cleaned. Mention is made of the reservoirs and their construction and condition so that it would be self-evident that the presence of algae in the water could not be charged to sunlight. Often in the autumn months the offensiveness, both to taste and smell, was almost past endurance, and even in the winter months the odor and taste in the water could be readily detected at the hot water faucet. At the time of the greatest distress a suggestion was offered to very high authority that the trouble might be traced to the compressed air, that is, that the fungi might be carried in from the open atmosphere with the compressed air and their growth encouraged and propagated by the warmth imparted by the frictional heat. At that time the suggestion met with a strong negative opinion.

Since then this theory has been under the expert's scrutinizing investigations, and it has been conclusively demonstrated that certain forms of algae live and thrive best without light, and when once imparted to the water find congenial elements for growth in the dark recesses of the water mains. It is a demonstrated fact that our trouble came from the compressed air source, for, as stated before, there was no trace of algae prior to its use, and they entirely disappeared with its discontinuance.

A somewhat extensive experience in other fields, not only in this, but other States, has convinced me that compressed air is a breeder of trouble, that in almost all cases, if not every case, where compressed air is employed for raising water, the presence of algae in some form and to some extent can be found, and this whether the storage is covered or open.

The ground level of the water has lowered about one foot per year during the last twenty years; at first more rapidly, of late very slowly, until at present the static head is twenty-six feet. It seems certain that the next twenty-four feet to the point of the beginning of the water-bearing stratum will offer stubborn resistance to further decline, on account of the large area that supports this subterranean supply. The statement of "large area" is made for the reason that this stratum is drawn upon for water all over Clinton County, and the uniform lowering of the head is well observed.

Deep well augur or impeller pumps, driven by vertical electric motors, direct connected, have been in use since February, 1907; one six-inch and one eight-inch being sufficient to furnish the present requirements. Before installing these pumps nineteen wells were used. A sufficient supply can be obtained now by running the eight-inch pump from 6 o'clock a. m. to 6 o'clock p. m., delivering 700 gallons per minute, and the six-inch pump from 6 o'clock p. m. to 6 o'clock a. m., delivering 408 gallons per minute. The six-inch pump has sixty feet of shafting and requires nine and nine-tenths horse-power for operating, using $3.00 per ton R. M. coal. The fuel cost per thousand gallons for raising water into storage reservoirs, based upon a daily average pumpage for 1909 of 755,756 gallons, was 2 9-10 mills, or 22 horse-power for twelve hours, and ten horse-power for twelve hours, an average of sixteen horse-power.

The last year compressed air was in use, with the static head of the ground water very much higher, the fuel cost per thousand gallons for raising the water into the same reservoirs was 4½ mills. A Rand Duplex Air Compressor with Myer gear was used, the size of the steam cylinders being 12x16 inches, air end 14x16 inches, having a capacity of 570 feet of free air per minute at 100 revolutions with 60 pounds of air and 80 pounds of steam pressure.

HIGH TEMPERATURE GARBAGE AND REFUSE DESTRUCTORS.*

By Col. W. F. Morse, Consulting Engineer, New York City.

WHEN a municipality has determined to adopt a modern scientific method for the disposal of its waste, the preliminary work of an examination of the local conditions, estimates of the quantities to be dealt with, and an approximate analysis of their composition, is the first step to be taken. As a rule, American municipalities do not attach sufficient importance to this subject of waste disposal and are therefore without accurate data except in a few instances; but with the information now at hand, any city engineer can obtain for himself a knowledge of the quantities and the seasonal variations, can make an analysis of their composition and obtain an idea of the total volume such as is necessary for estimating the size of the disposal apparatus that would be most suitable for the special conditions.

Once the preliminary work is completed, it then becomes necessary to determine which of the several methods now in use in this country will be the most satisfactory and economical for the purposes of the city. There are two methods employed. The first one is reduction, meaning the digestion of the garbage and putrefactive matter by a steam process in large iron tanks, the recovery of the oil or grease for the market, and the treatment of the residual called tankage, as a base for fertilizer. Since a reduction works frequently gives off offensive odors, it is not advisable to locate one near a populous district, and therefore this method is handicapped by the cost of the long haul. Further, by this method the problem of disposing of the city's waste is only partially solved; there still remain to be taken care of the household ashes, which always contain a large percentage of combustible material, and the general rubbish, which consists largely of paper, excelsior, wooden boxes, old rags, and a great variety of materials which are combustible. Under this method (reduction) the ashes and rubbish must be placed by the householder in separate receptacles from the garbage, and must be collected in different forms of carts by the scavenging department, thus requiring two, or generally three, visits to each house before all of the waste can be removed. The ashes under this method are generally used for filling low land, without any attempt to utilize the combustible material, and the general rubbish, when not dumped upon vacant land, must be disposed of in a central rubbish burning plant.

The second method, and the one in use in the largest number of instances, is the cremation of all the waste by specially designed destructor furnaces, which are placed at a central point selected with a view to requiring the minimum length of haul for the collecting wagons. This point should always be near to the heart of the most densely populated portion of a city, and can only be chosen when the furnaces are of modern design and can, therefore, be relied upon to operate without nuisance or offense to the neighborhood.

For twenty years American municipalities have been destroying garbage only, separated from the refuse and ashes, by the use of crematories and incinerators. There have been built upwards of 225 of these furnaces, of which more than one-half have been found unsatisfactory and inefficient in operation and have passed out of use, and the remaining number are rapidly being set aside in favor of a more scientific and efficient apparatus for destruction by fire.

Recognizing the limitations of the imperfect combustion of waste by crematory methods, there has lately been introduced another and far more powerful form of cremating furnaces called destructors, which deal with all classes of city waste taken as a whole without any attempt at separation. Manifestly the advantage of such a comprehensive system is vastly greater than one which would be limited to a destruction of only a part of the municipal waste, leaving the remainder to be dealt with by other means, and at additional cost.

The destructor system originated in England more than thirty years ago as the outcome of a situation which compelled the destroying of the town's refuse by fire, owing to the limited area for its disposal in the neighborhood of the cities.

Actually originating in London, it

*A paper before the American Society of Municipal Improvements.

was afterwards put to a thorough trial in Manchester, where the advantages of the new method were fully demonstrated. From this beginning it has grown into general use in Great Britain, there being at the present time something like 300 municipal destructors of some six or eight different types or makes in use. This method is the only one employed for the disposal of the city's waste except in one or two isolated cases where the towns, being on the seaboard, have an opportunity of disposal by sea dumping.

The gradual evolution of the destructor proceeded from the first crude form of cell furnace, through a process of development which included a supplemental fume crematory, and led ultimately to the adoption of powerful forced draft at high temperature and the introduction of large steam boilers in direct connection with the furnace. These improvements were the gradual growth of twenty-five years, and at the present time may be said to be the most satisfactory, efficient and sanitary method for the disposal of all public waste that is known to the civilized world.

In this country we began twenty-five years ago by the erection of a crude form of cremating furnace, continued this in many places and under various conditions and difficulties, and we have persisted in repeating the same general form of construction with but few minor changes, down to the present time. This is the form of American crematory, or incinerator, which has been not entirely satisfactory in public service. About three and a half years ago the introduction of the British form of destructor was first made in Westmount, near Montreal, after an extended examination by competent engineers, and the first destructor was erected and put into operation in the spring of 1906. The results reported from this destructor were in all respects entirely satisfactory as regards efficiency, sanitary operation and reasonable cost for operative service. Following this a destructor of a similar type was installed in another Canadian city, Vancouver, B. C., and a still larger installation was made in one of the boroughs of New York City, Richmond, Staten Island. About the same time one of the larger western cities (Seattle) installed a destructor, and one of the great industrial companies, the General Electric Company at Schenectady, built a destructor for the disposal of the refuse from its works. These five installations, covering a period of about three and a half years, have so firmly established the destructor method that other large cities have, after a prolonged investigation, adopted this method and have issued specifications calling for the construction of large plants within thickly settled parts of the municipalities. One of the western cities (Milwaukee) has now under construction a destructor plant for the disposal of three hundred tons daily, while Buffalo is constructing a forty-ton addition to the present works, the new part being designed on modern destructor lines.

It is a very significant fact that in every one of the five instances, viz., Westmount, Seattle, West New Brighton, Vancouver and Schenectady, where the destructors have been in operation a sufficient length of time to demonstrate their value, they are now advocating the construction of additional units for the disposal of larger quantities and the obtaining of greater steam power. All of these installations are built upon lines similar in construction and in operation.

A destructor must fulfill its initial purpose, which is the disposal of waste and offensive matter without nuisance and at reasonable cost. In doing this whatever results that may be obtained from the combustion are to be regarded as an asset which will return a revenue to the city. The American crematories do not succeed in obtaining any revenue from their works and consequently the disposal of a part of the waste only—the garbage—is accomplished at the expense of a considerable amount of fuel and labor which is a total loss to the city. The destructor in its work develops a volume of heat which is sufficient to operate large steam boilers, which power is in turn applied to the purposes of the city for electric lighting, pumping water, sewage or other municipal uses. Furthermore, the product or residual resulting from disposal by the high temperature destructor is in itself a valuable asset, and supplies the place of broken stone or other material when employed for concrete work.

The advantages to be derived from the introduction of the destructor system as compared with the crematory system may be included under the following headings:

First. The sanitary operation of the destructor is far more efficient than that of the crematories. Nuisance from the disposal of waste by fire comes from the chimney because of low temperatures. The crematories do

not as a rule attain a temperature higher than 1,500 degrees at the fire box, and as these gases pass to the chimney they become cooled until at their exit they frequently fall below 350 degrees, thereby creating odors from their stacks. The combustion of garbage or any form of household waste which contains organic matter must be accomplished at a temperature high enough to destroy not only the material left itself, but the gases thrown off from its combustion. This minimum temperature is fixed by many prominent authorities at 1,250 degrees Fahr. Manifestly any system which falls below this temperature will discharge into the atmosphere a noxious compound of empyreumatic gases, which will fall to the ground and create nuisance. The destructor proceeds on a different plan. The initial temperature at the fire box approaches 2,000 degrees Fahr., and in its passage through the combustion chamber this is increased and maintained at from 2,000 to 2,500 degrees Fahr., thereby insuring the absolute destruction and conversion to CO_2 of all organic compounds.

Second. The production of high temperatures in the destroyal of all mixed waste of the city, assures that a steam boiler can be kept in operation during the time the waste is supplied. This is accomplished by the use of a forced draft under the fire bars, derived from the passage of air through a re-generator, or preheater, by which it is raised to a temperature of 350 degrees before being introduced under the fire box. The result of this process is the production of a volume of heat, which, when passed through a boiler, gives a constant high steam pressure and insures the operation of machinery which may be attached thereto at a uniform rate.

Third. The advantage in the destructor system is the incineration of the waste to such a degree as to absolutely destroy every form of organic compound or combustible material, whether solid or gaseous, and reduce the residual to a clinker, vitreous and solid in character, capable of being broken up for use in concrete and other work, or it may be used for the manufacture of bricks or tile for municipal purposes. The clinker produced by a destructor is everywhere recognized as an asset and gives a return in money of greater or less sum according to the demand for its use.

Fourth. The advantage of a destructor system is in the fact that its installation may be made at a point within the limits of the city itself and not far removed from the collection district. The moving of a ton of garbage by the agency of a team of horses and men one mile, costs in the neighborhood of 75 cents to $1. When this is multiplied by a large number of teams over a long period of time the expense becomes very great. By the erection of a destructor at some central point where the transportation is reduced, the cost of the service is very greatly diminished. A destructor centrally located, operating without nuisance, developing power for municipal purposes, and using its by-product of clinker for municipal work, has very many advantages over the former method of cremating the garbage only at a point far removed from the city itself.

Fifth. The collection of the waste of a municipality is one of the greatest expenses in connection with the city government. The present practice of making a separation of the wastes involves an expense to the householder for equipment and for service which in many cases is very onerous. Where there are three separate collections of garbage, refuse and ashes there must be maintained three separate vessels with all the attendant care required. The single method of collection, unsorted and unseparated, is much to be preferred to the usual method obtaining in this country. If a load taken from a household includes all the waste of every character from the house, it is done at one operation and at one time, and with a much greater economy of labor than if there were three services performing the same work. The usefulness of the destructor system is found in the fact that the householder may at once eliminate from his premises every form of waste by one service, and it is then brought to the furnace and destroyed without any separation and with the greatest economy in time and labor.

The experience of the past four years in the introduction of the destructor system in this country has thoroughly demonstrated its satisfactory operation as demanded by the boards of health in point of sanitation; by the city authorities in point of economy; and by the city engineers in the production and application of steam power. Thus it is that some of the largest cities in the country are now introducing this method under the advice of experienced and compe-

tent engineers, who have investigated the question of the disposal of waste in every part of the civilized world, and have recommended the destructor system as being the most efficient and most economical known.

For an average American city of 100,000 population it would be fair to assume an estimated daily waste of 130 tons of mixed refuse per day, which would be collected by the scavengers and delivered to the destructor plant. This would comprise all the garbage, rubbish and ashes from residences, but not from power plants or factories. For such a city it would probably be best to build one central plant located in the most populous portion of the city, so that most of the material would be subject to short haul, enabling each cart to make several trips a day except to the outlying districts.

The cost of a plant to consume 130 tons per day would be from $110,000 to $130,000, depending upon the elaborateness of the buildings for housing the destructor, or would average about $120,000 without real estate. At the average rate of wages the operating cost of such a plant would be 35 cents per ton for the refuse consumed, or $45.50 per day. A conservative estimate of the amount of steam which would be produced under high pressure in a boiler by the heat from such a plant would be 32,500 pounds per day, which would be equivalent to 20 tons of coal, which at $3 per ton would be worth $60 per day. There would also be at least 40 tons of clinker delivered from the plant, which, if sold at 50 cents a ton, would yield a revenue of $20 per day. The coal and clinker would, therefore, give a credit to the plant of $80 per day, leaving a balance of $34.50 per day over operating expenses amounting to $12,601 per year. If the plant costs $120,000, a fair allowance for interest, repairs and sinking fund would be $12,000 per annum, leaving a net annual income of $601 which this plant would earn. Stated in tubulated form, the figures are as follows:

FINANCES OF PLANT FOR 100,000 POPULATION.

Population		100,000
Estimated daily waste, tons mixed refuse		130
Cost per day of plant to consume this amount, $110,000 to $130,000, averaging about $120,000.		
Cost of operation at average wages, 35 cents per ton, $45.50 per day.		
Revenue from 32,500 lbs. steam, equivalent to 20 tons coal per day, at $3.00	$60.00	
40 tons of clinker at 50 cents	20.00	
	$80.00	
	45.50	
Profit for year 365¼ × ... $34.50	= $12,601	
10 per cent. to cover fixed charges (interest 5 per cent., repairs 1 per cent., sinking fund 4 per cent.)		12,000
Net annual income		$601

This is not an unreasonable expectation and there are possibilities for greatly increasing the revenue by utilizing the steam for more valuable purposes, or by selling the clinker at a higher price than 50 cents per ton. Steam generated from such a plant, wherever a steady load is carried throughout the day, can be used for pumping water or for pumping sewage, or for making ice. This last means of disposal of steam is particularly appropriate since the steam generally delivered from a destructor is just about of sufficient quantity to furnish the average amount of ice consumed by a community of the size which the destructor is capable of serving, when the ice is manufactured by the absorption process. The clinker may also frequently be sold for considerably higher price than 50 cents per ton. It is in great demand for building purposes, being better than cinders for mixing in concrete for floors or partition walls.

The advantages of the short haul, which this method enables, furthermore serve to reduce the cost of collection about 30 to 40 per cent. Assuming that it cost the city $1.50 a ton to make collections by other methods and $1 per ton when destructors are used, the saving of 50 cents a ton, amounting to $23,733 per year, should be added as a direct credit to the destructor system.

These figures will serve to demonstrate the claims above made that, having first met the sanitary requirements by adopting the high temperature destructor system, a city also has it within her grasp to adopt a system which is more than self-supporting, and, therefore, the most economical.

EDITORIAL COMMENT

The Organization for Standardizing Paving Specifications

Qualifications of Engineers and How to Determine Them

THE ORGANIZATION FOR STANDIZING PAVING SPECIFICATIONS.

There have been so many more or less unsuccessful efforts to arouse interest in standard specifications of various sorts among municipal engineers that no one was prepared for the enthusiasm which was manifested at the meeting which was called by the Mayor and the Department of Public Works of Chicago for the purpose of formulating standard methods of paving streets.

Some of this interest was fore-shadowed in the recent convention of the American Society of Municipal Improvements at which one of the most important steps that organization has taken in years was made by appointing a general committee on standard specifications with instructions to appoint special committees to prepare and present specifications for all classes of municipal work. Considerable enthusiasm was shown among the members of this staid, easy-going organization and the committee has been appointed and is about to begin its work.

But its movements are too slow for pushing Chicago and one of that city's officials, who does not happen to be an engineer and perhaps thought himself not eligible to membership, did have an assignment upon a committee to revise the Chicago street construction specifications in time for the season of 1910 and, unusual as that may seem, wanted to know what other cities were doing. He soon found out that no two of the larger cities were doing the same thing, and then he asked for the convention. He made his request early in February and a week's almost continuous session was ended on the second of March. This was quick work, and good work too, for he had representatives from the construction departments of 41 cities and four of the five members of the general committee of the American Society of Municipal Improvements. Of the 44 cities having over 100,000 population 26 were represented; 7 of those of 50,000 to 100,000 population; 4 of 30,000 to 50,000 population and 4 of still smaller size, although the first formal invitations were sent to the cities of more than 100,000 with a few additions.

It was a working convention. Large committees were appointed, who assigned special subjects to sub-committees, and by applying themselves strictly to business were able to present excellent reports at the sessions of Thursday, Friday and Saturday. Some of these reports are printed in this number of MUNICIPAL ENGINEERING and others will follow in the May number.

The convention early decided that it could not settle all the questions presented to it in one meeting, and made arrangements to meet again in January, 1911, in New York City, to take up the questions which were given only tentative answers and those to which no answers were given.

The name adopted for the rather loose organization which was formed is "Organization for the Standardization of Paving Specifications" and is very appropriate, for it indicates the purpose of the convention and its extension into next year. Two or three meetings under programs in accord with this name and purpose will very nearly fulfill the ends of its existence and then it must either die, combine with some other organization or expand its field.

So much energy as is here manifested should be kept busy, and one of the latter alternatives should be chosen.

The American Society of Municipal Improvements is an organization with many years of most excellent work behind it, one branch of whose work includes the objects of the new organization. Most of the cities represented in the new organization are members of the older one. Many individuals are members of both. Their objects are the same and the older society supplies the larger field which the new organization must expand into if it is to continue its existence indefinitely. Both organizations are equally free from entangling alliances of any kind. Whether considered from the standpoint of the new organization with its present name and purpose or with a desire for expansion, therefore, alliance with the older organization is desirable. Now that the special purpose for which the convention was called, the revision of Chicago paving specifications, has been accomplished, the organization can very properly transfer its activities to the existing association covering the whole municipal field. The American Society of Municipal Improvements should welcome the new blood and the new enthusiasm which its own members have imbibed from the new organization. It needs some of the snap and energy so well exhibited at Chicago.

The proposal for an alliance was presented to the executive board of the new society after the adjournment of the convention at a meeting at which five members of both societies were present, and a committee was appointed to meet with the American Society of Municipal Improvements in October at Erie, Pa., and still further consider the matter.

QUALIFICATIONS OF ENGINEERS AND HOW TO DETERMINE THEM.

The inquiry in the "Question Department" concerning the method of securing good bridge plans, the occurrences mentioned in the answer, the paper on "Engineering Ethics" which F. H. Snow, Chief Engineer of the Pennsylvania Department of Health, presented to the Pennsylvania Society of Engineers, and the procedure of state health departments regarding the qualifications and reputation of engineers having business therewith suggest some subjects for consideration which are becoming daily more important to engineers and to the public.

It has long been a matter of chance in all but the largest cities, and sometimes in them, whether a good engineer was obtained, and the successive consulting engineers and commissions sitting on the same proposition have not seldom seen the decision made in spite of the technical advice, good, bad and indifferent which has been offered. The number of educated engineers has increased quite as rapidly as the population, but they have not had the self-protective spirit and, instead of combining to better the conditions have fallen into the unprofessional procedures imposed upon them by the ignorant officials having the work in charge.

The public is no less interested in the process of choosing an engineer than the competent engineer himself and, whether engineers desire to have their qualifications for their work passed upon by competent authority or not, the public is vitally interested in the question and is likely to wake up and demand its protection at any time.

In private business there is not the same necessity for protection from incompetence, because tenure of office is longer and knowledge of the business is more detailed, more thorough, and subject to closer checks; naturally, since the private business spends money in order to make it, and success is measured by the profits, while the business of the municipal or other public official is to spend money outright and he has no profit-measure of his success.

Occasionally some control of the competence of enginers in municipal work has incidentally come to a state body, such as the State Board of Health, through a provision of the law requiring approval of sewerage, water supply, and other engineering plans by such bodies. If the control extends only to approval or disapproval of plans it is salutary and may be exer-

cised without prejudice or favoritism, but if, as has sometimes been rumored, it extends to the statement of names of engineers whose plans will be accepted and those whose plans will not be considered, then there is room for doubt as to the competence and honesty of the controlling body. The question before the board with regard to any particular set of plans is not as to the reputation or experience of the engineer preparing them, but as to the sufficiency of the particular set of plans.

Only a small proportion of municipal work is covered by the controls named and the evidences of incompetence in other lines are quite as numerous as in those included therein. The ordinary board of county commissioners does not know how to choose a bridge or drainage or highway engineer. The ordinary city council does not know how to choose a city engineer or a consulting engineer for some particular work. When these officers are elected the same lack of knowledge prevails.

As regards highway work some states are providing that it shall be in charge of a state highway commission and engineer and that the county engineers or supervisors shall have their competence certified by the department. The supervision of municipal book-keeping and of municipal operation of public service industries is being put into the hands of state commissions, and the qualifications of local officials in these departments must shortly be tested and approved by the state department if the full benefits of state expert supervision are to be secured.

It is but one more step to fix the qualifications for all classes of engineers and technical employes of city and county. The obvious way to apply this test is to classify the offices according to duties, population, etc., provide methods of determining the qualifications of applicants for such employment, establish eligible lists from the results of these determinations, and provide that every employe of the city in these departments shall go through the necessary steps to get his name upon the list.

Engineering schools usually report the lack of interest in the courses treating more particularly of municipal engineering subjects, because of the present low standing of that branch of engineering work. This is due to the lack of consideration of engineering knowledge and experience in making appointments, the brief tenure of office, the low salaries, the unprofessional, not to call it ungentlemanly, treatment of the engineer by too many city councils and mayors.

Could this branch of the profession be brought up by a legislative demand for competence, enforced through a state board of high technical and business qualifications, the other disadvantages under which it labors would probably disappear in the natural course of events.

This is not a control of the engineering profession at large, such as so many engineers object to, but is a natural protection of the governmental organizations of the state against incompetence in technical employes, which, in the very nature of their method of selection the governing bodies of city, county or state are not able to determine satisfactorily. It has nothing to do with the ethics of the engineering profession, in the lines in which there is any such development, and makes no effort to reform the profession voluntarily or involuntarily. It is simply a matter of self-protection to the public.

THE QUESTION DEPARTMENT

Cost of Filter and Standpipe.

We are thinking of submitting the proposition of erecting a standpipe and filter for our waterworks at our spring election. We are a city of about 5,000 inhabitants, have now over 400 consumers and still growing. Will you kindly inform me the cost of such a standpipe and filter suitable for a city of our size?

L. R. S., Olathe, Kan.

Only the most general sort of estimate can be made, in absence of detailed information as to local conditions and the use to be made of the standpipe or elevated tank. The latter may be the more economical in many cases. The cost of the standpipe for the city named should not exceed $5,000, unless there are some special circumstances increasing it, and a competent engineer may so design the plant as to reduce this cost materially. A mechanical filter plant should not cost more than $2,000, and may cost much less.

Pumps and Well Machinery for Water Supply.

We are contemplating sinking additional wells for our public water supply, and would appreciate any information that you could give us in regard to pumping machinery, methods of sinking wells, etc. A. C. G., Hillsboro, Ore.

The best treatments of these subjects will be found in Turneaure and Russell's "Public Water Supplies" ($5) and Goodell's "Waterworks for Small Cities and Towns" ($3), the latter book being about twelve years old and the former having new editions frequently, the latest scarcely two years since. This department will be pleased to give information in answer to specific questions and would also refer the inquirer to the engineers and contractors whose names will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING under the headings "Civil Engineers," Consulting Engineers," "Contractors," etc.

Articles on Water Tight Joints for Vitrified Pipe.

Can you refer me to any of your back numbers now available that contain information on the construction of water-tight joints for vitrified pipe operating underheads. The case with which I am dealing is a series of 12-inch inverted siphons, operating under heads from 6 feet to 21 feet on a water supply line. While I feel that the matter is solved, I shall be pleased to know the experience in similar matters elsewhere. If the back numbers are available, kindly inform me as to the price of the same.

C. R. B., Lamar, Col.

In vol. xxxi, p. 182, is a brief article on "Concrete Water Pipes," in which the statement is made that such pipes had been tested to 40 pounds internal pressure of water, with some leakage, which did not appear at the joints.

In vol. xxx, p. 35, is an article on "Asphalt Pipe Joints," but the pipes were sewer pipes, and no information is given about the tightness of the joints under head.

In vol. xxix, p. 403, is an article on "The Use of Vitrified Tile Sewers as House Drains," in which some experiments are reported, which describe the method of making joints which stood 30 pounds' internal water pressure without leakage.

In vol. xxvii, p. 357, is an article on "The Use of Sulphur for Sewer Pipe Joints in Wet Trenches," which does not give any information about their resistance to internal water pressure.

In vol. xv, p. 90, is an article on "Sewer Pipe Joints in England," some of which were tested to 28 pounds per square inch internal water pressure before signs of leakage appeared.

In vol. xx, p. 76, is a brief statement of some advantages of vitrified pipe for water conduit lines, and on page 89 is an illustrated article on "Vitrified Pipe Conduit, Hartford Waterworks," in which it is stated that a part of the pipe is under a head of 9.65 feet of water and the method of making the water-tight cement joints is fully described. On page 151 is a brief discussion of the subject, concluding that the maximum pressure in vitrified pipe lines seldom exceeds 5 pounds per square inch. On page 355 is a statement regarding the Little Falls vitrified pipe conduit, that it was seriously injured by being subjected to a head for some days for which it had probably not been designed or constructed.

The numbers referred to can be supplied at 25 cents each, except vol. xxx, p. 35, and vol. xx, pp. 151 and 355.

Economy and Strength of Boilers.

Our borough is about to purchase a new 125 horse-power boiler with which to operate its pumping plant, and a street lighting system. The question of economy of the different types of boiler is being discussed, and I would like to have you give me any information you have immediately at hand in regard to the difference in economy betwen the "standard horizontal return flue brick set boiler" and an "internal furnace, tubular boiler" with brick backs (90 inches by 12 feet 6 inches); also on the internal furnace boiler, what is the best practice as to riveting girth

seams, should it be single or double riveted, and why?

J. A. B., City Attorney, ———, Pa.

The first question should be put to a mechanical engineer, who is given an opportunity to inspect the drawings and designs for the boilers and installations of boilers of similar design, or is familiar with boilers of the designs proposed. The economy of a boiler depends on so many elements of design and construction of both boiler and furnace, as well as conditions of operation, that no definite answer could be given without the detailed knowledge referred to.

If the circumferential joints of a boiler are single riveted, the longitudinal joints should be double riveted, the tension being twice as great on the latter joints.

Will our readers give their experience in regard to the first question, including full details of boiler, furnace and method of operation?

Cost and Efficiency of Electric Power.

1. What is the average cost of an electrical horse power per year of, say, 3,000 or 4,000 hours?

2. What is a fair average estimate of efficiency of the eelctric motor in delivering from prime mover?

3. In calculating electrical horse power, is the 746 watts used for one second or one minute of time. as for the steam engine?

Please explain these matters, if I am not intruding too much upon your valuable time in asking that much of you.

E. B. D., ———, Ind.

1. The cost of supplying electricity varies according to conditions. In a table published in Suplee's "Mechanical Engineers' Reference Book" ($5), the cost of electric power varies from 0.4 cent to 7.5 cents per kilowatt-hour. For lighting in a small works, subject to varying load, perhaps 3.6 per kilowatt hour would be a reasonable figure. As a horse-power is 0.746 of a kilowatt, the cost per horse-power for a year of 3,000 hours would be $80, and for 4,000 hours, $107.

2. The efficiency of dynamos varies from 70 to 96 per cent. Probably the commercial efficiency when the plant is running near full capacity will be somewhere near 90 per cent, but it will be less as the load on the machine diminishes.

3. An erg is approximately the work done when a milligram is raised one centimeter. A watt is equal to 10,000,000 ergs of work done per second. In the same units, a horse-power is equal to 7,460,000,000 ergs per second. It follows that 746 watts equal one horse-power, or a horse-power equals 0.746 kilowatt. Likewise, a horse-power hour equals 0.746 of a kilowatt hour. Each unit expresses a rate of doing work and the ratio of the rates for the same work performed is the constant given. In Foster's "Electrical Engineers' Pocket Book" ($5) is a table of equivalent values of electrical and mechanical units, which states that a kilowatt equals 44,240 foot-pounds per minute, and a horse-power equals 33,000 foot-pounds per minute, or 0.746 kilowatt. Such mechanical engineers' and architects' pocket books as Supplee's and Kidder's make serious errors in some of their definitions of electrical units and equally erroneous statements of the relations of the various units.

Photometer for Testing Electric Street Lamps.

Will you kindly inform me where I can find out if there is a way of measuring or testing the candle power of arc and incandescent electric lights while the lights are working? We wish to see if we are getting our full candle power, and will esteem it a great favor if you will give us the information.

L. R. S., ———, Kan.

Descriptions and illustrations of various photometers, luminometers, illuminometers, etc., all being apparatus for measuring the comparative intensity of illumination, will be found in MUNICIPAL ENGINEERING, vol. xxiii, p. 106, and vol. xxvi, pp. 257 and 323. They are sold by some of the dealers in engineering instruments, whose names will be found in the "Business Directory," published in each number of MUNICIPAL ENGINEERING under the heading, "Engineering Instruments," particularly W. & L. E. Gurley, Troy, N. Y. They are also sold by the dealers in electrical apparatus, such as the General Electric Co., the Electric Motor and Equipment Co., etc.

Machines for Briquetting Fuel.

Can you give us any information in regard to machines for briquetting coal or coke, or can you refer us to any one who makes machinery of this kind?

W. W. B., Dubuque, Ia.

The following firms manufacture fuel briquetting machines; Commercial Artificial Fuel Co., Toledo, O.; Mashek Engineering Co., 141 Broadway, New York; National Fuel Briquette Machine Co., 90 West street, New York; Traylor Engineering Co., Allentown, Pa.; United States Peat Fuel Co., Ft. Dearborn Bldg., Chicago; U. S. Rapid-Fire Gun and Power Co., Derby, Conn.

Pump for Small Quantities of Sewage.

It is proposed to pump sewage amounting to 8,000 gallons per day, present flow, a vertical height of 125 feet (allowing for friction in pipe for a horizontal distance of 3,000 feet). We would like to find the most economical pump to install and the proper size for the receiving well, allowing for an ultimate flow of 25,000 gallons per day. It is intended that this sewage be pumped into an 8-inch tile pipe, which is part of an old system already constructed.

We would also like something as to methods of continuous pumping, so that this 8-inch pipe would not be taxed beyond its capacity.

W. C. & S., ———, N. Y.

An 8-inch tile pipe laid on a minimum gradient of 1 in 400 will carry about 250 gallons a minute, running full, at a velocity of about 1.5 feet a second. The

sewer as laid will probably carry more than this amount, but it has to carry also the sewage coming into it along its course. The pump capacity should not exceed the capacity remaining in the receiver pipe to carry the pumped sewage. According to standard methods of design as developed in books on sewage, the capacity of the pump may therefore be limited to about 125 gallons a minute. This is probably about five times the maximum rate at which the sewage will come to the pump when the system is developed to the capacity of 25,000 gallons a day.

A rotary pump, self-priming, would be recommended by many, using electric power if possible, and automatic devices for starting and stopping the pump, letting the pump work intermittently, the length of pumping period depending upon the size of the receiving well.

It would not be difficult to design a well for the full capacity of the system which could fill up during a certain number of hours and then operate the pump, by electricity, steam, gas or gasoline during certain hours of the day, the assumptions being of the total flow during the day and night, the maximum flow at certain hours of the day, and the pump capacity (say 125 gallons a minute), and the quantity to be worked out being the size of the receiving well. The number of hours of operation of the pump would depend on the amount of sewage coming to it. The pumping might be done at night and then greater capacity of pump could be used because the high level sewer would not run so full at night. The receiving well would be larger, however, on account of the larger flow of sewage in the day time.

Careful screening, ample opportunity for cleaning receiving well, pump and pipes, with all the necessary gates and waste ways, must be provided.

The intermittent system would probably be more satisfying than any attempt at continuous pumping.

Have our readers any suggestions to offer?

Day's Work on Trench.

I would ask that you tell me what, in your opinion, or from such information you have pertinent to the matter, would be the average daily work, in cubic yards, for a man digging a trench, two to three feet wide and nine feet deep, in hard, stiff material, requiring use of pick to dislodge it before material can be shoveled.

M., Paterson, N. J.

In vol. xxi, p. 406, of MUNICIPAL ENGINEERING is an article on the "Estimation of the Cost of Sewer Construction," which goes into detail regarding all the items of cost. One paragraph reads as follows:

"In good work an average one day's work of ten hours will be required to excavate and refill, carefully tamping, a trench in common earth 8 feet deep and 15 feet in length for 6-inch pipe service; 12 feet for 8-inch; 11 feet for 10-inch; 10 feet for 12-inch; 8 feet for 15-inch; 7.5 feet for 18-inch; 6 feet for 24-inch; 4.5 feet for 36-inch pipe sewers, if done under strict supervision, while, if left without inspection except his own morals to guide him, the contractor can have about 20 per cent more work done in the same time." The widths of trenches at bottom are 6 inches more than the outer diameters of the bells, with side slopes of 1 in 20, and the tamping is done in 6-inch layers.

In vol xviii is a table giving "Cost of Laying Vitrified Pipe Sewers at Various Depths," for computing which an average day's work of a man is assumed at 11 cubic yards in such trench work. In this case, also, the material is excavated and refilled, and apparently the same capacity per man is assumed for both trenching and back filling.

From McCullough's "Engineering Work in Towns and Small Cities" is a table from which a rate of about 8 cubic yards can be deduced as a day's work, digging trench. He states that a day's work back filling is about 10 cubic yards, with pick and shovel. Tough clay would reduce the day's work about one-third, and this will apply to all the figures preceding.

At Corning, N. Y., in a water pipe trench 5 feet deep in loamy sand and gravel, one man excavated 6 cubic yards in 10 hours as the average of the work. At Rochester, N. Y., one man excavated 8 cubic yards a day, and back filled 16 cubic yards a day in similar material. Hard clay would again reduce the output per man by about one-third. A depth of 9 feet would also increase the cost somewhat.

From the above figures and assumptions it may be concluded that one man may be expected to average from 5 to 6 cubic yards a day, with the probabilities in favor of the lower figure in hard, stiff material. To attain this average, his rate while actually shoveling must be materially greater.

Will our readers report their experience in this line? Contributions to our knowledge of the details of this subject are very much needed.

Garbage Disposal for Small City.

We are in want of some information in regard to methods of and plant for destruction of garbage. We have now only about 3 or 4 tons per day of wet and dry to dispose of, but the city is growing. We are hauling garbage about one mile from the city and dumping it, with our own carts and wagons. The garbage ground produces more flies than the entire city.

B. G. Fox, M. D., Health Officer,
Globe, Ariz.

Morse's "Collection and Disposal of Municipal Waste" ($5) gives the fullest treatment of the subject of garbage disposal. It has been somewhat difficult to burn the smaller quantities of garbage collected in small cities, but Mr. Morse has descriptions and brief references to several small plants, even small enough

to be portable. And there is a new one, which has a test of a couple of years, but has been put on the market too recently to get into even Mr. Morse's new book. This is the Thempson crematory, which is built by the Weber-Duller Co., of 329 Commercial Bank Building, Houston, Texas, and 660 Pacific Electric Building, Los Angeles, Cal. Some description of the furnace will be found in the January number of MUNICIPAL ENGINEERING, vol. xxxviii, p. 63.

How to Procure Good Bridge Plans.

If I may do so without imposing upon your courtesy, I wish to again make use of your Question Department. And I take this opportunity to express my appreciation of the valuable information which I have received from MUNICIPAL ENGINEERING heretofore when making similar inquiries.

We have a bridge which is old and unsafe, and should be renewed. Whether the work will be done in the near future or not is a different question, and not for me to decide. But I wish some information as to the best method of handling the matter when it does come up. Before my appointment as city engineer the city advertised once for bids, the bidders to furnish plans and specifications. This, of course, was not very satisfactory, as each bidder was bidding on a separate set of plans, and there was practically no competition. The old bridge is a swing bridge about 140 feet long, carrying double street car line and driveway, walks, etc.; is on our principal street, and crosses Black River, which is navigable at this point. It is too light for modern conditions, having been built twenty-six years ago, and has deteriorated a good deal from rust.

I am not a bridge engineer, and could not undertake to prepare detailed plans and specifications for a bridge of this kind, and would not have time to do it in connection with my other duties, anyway. Under such circumstances, what would you consider the best method of procedure: To hire some well-known and capable bridge engineer or engineering company to prepare detailed plans, specifications, estimates, etc., the city council to first determine the general dimensions, approximate amount of money to be expended, etc.; or would it be possible and practical to advertise for bids for furnishing such plans, specifications, etc.? And what is the usual charge for such work, including inspection of work, based upon percentage of cost of structure? City Engineer, ———, Mich.

The method of advertising for bids on a bridge, plans to be furnished by the bidder, is a bad one, because it really does not give a fair basis for competition. It requires a competent consulting engineer to insure that the accepted plan is either safe or economical. To the engineer it is objectionable because it takes the technical work out of his hands and puts the decision of the engineering merits of structures in the hands of men technically ignorant, unless, as is very seldom the case, the consulting engineer referred to is employed to pass upon designs and bids.

The method of calling for plans from engineers in a competition is objectionable for the same reasons, and the consulting engineer is absolutely necessary if the best and most economical design is to be secured. Men of all grades of intelligence and training will present plans and the least competent man will most probably offer his plans at the lowest price. The differences in price will be considerable, and the low prices will be attractive to a council committee who probably will not know that money saved in procuring plans may be lost several times over from the errors or extravagances of an incompetent designer. An architectural competition is based upon a different principle, for in such a case the competitors present simply sketches showing the general features of their designs, and the successful competitor is given the work of preparing the detailed plans and specifications, and the fee is fixed, so that it is not an item in the competition.

If the structure is an engineering structure only, probably the best results will be obtained if a competent designing engineer is employed to prepare the plans. He can be selected with the aid of the city engineer and others knowing where to find experts in this line, as readily as the consulting engineer, who is necessary for good results in the other two cases, and his fees would not be greater than those of the competent contestants in the competition, so that this method will save money to the extent of the consulting engineer's fee, as well as secure a satisfactory result.

If architectural or peculiar engineering features are involved, it would seem that a competition similar to an architectural competition might be held, sketches of the archtectural structure and of the methods of solving the engineering problems being presented, and the successful competitor being given the contract for preparing the detailed plans and superintending the construction.

In this sort of engineering competition the fee for preparing the plans should be fixed beforehand, just as it is in an architectural competition. One of the principal objections to engineering competitions as ordinarily conducted would thus be eliminated. Unfortunately, engineers are not united upon the question of compensation for their professional services, as are architects, so that the city officials must fix the fees for the work without help from any official action of any body of engineers of national prominence. It is customary among engineers, and also among architects, notwithstanding the fixed schedule of the American Institute of Architects, to make reductions in percentage charges as the total cost of the work increases. Thus, according to one formulated schedule, the whole fee for work costing less than $5,000 would be 10 per cent, of which one-half would be charged for the detailed plans and specifications, while for work costing $50,000 to $100,000 the corresponding per-

centage would be 5 and 2¾. These are reasonable fees for first-class service.

It will be possible, under the expert guidance of the engineer thus selected for his ability and honesty, to provide for the proper consideration of the patented features and entire structures which sometimes are demanded by the economic and engineering features of the problem. He will also supervise the preparation of the shop details, which are best left to the draftsmen of the plant securing the contract, since the methods of the different companies differ so much that one can do this work according to its own methods much more economically than if it must follow those of some other designer. The sufficiency and adaptability of these details must, of course, be satisfactory to the original designer or consulting engineer.

That the function of the consulting engineer is unknown to many city officials is shown by a recent occurrence. A certain small city had two sets of plans for a sewer system which it had paid for some ten and fifteen years ago, but had never constructed the sewers. Instead of employing the original designer or other competent engineers to bring their plans down to date, or employing a consulting engineer to advise them as to the proper mode of procedure or as to the sufficiency of the existing plans and the possibility of extending them to fit the enlarged city, the city officials, in their ignorance of the most economical procedure for the city, as well as of the correct line of action from a professional point of view, advertised for engineers to appear in person at the city hall on a certain date and make propositions for preparing plans. The mayor, being a physician, it might have been assumed that professional ethics would have some consideration, but his ignorance of the engineering profession was so dense that he called the designers of sewer systems architects.

This procedure is not surprising, for it is not new, but there responded to the invitation to give time and money to the city with small hope of return some ten or twelve engineers, ranging from those of highest standing down, and all but three were willing to enter into a competition in which price for the service was as much a part of the competition as the relative standing of the engineers.

The lottery in this case happened to bring a good result for the city, and this will encourage other cities to follow the same course of procedure. For the chance in this lottery, each engineer entering the competition was willing to throw away his professional character and enter the race on a business basis solely. The result is an irretrievable injury to the profession at large, as well as to every engineer engaged in the contest. Such competitions have been engaged in by competent engineers before, but not with such an array of high-grade talent, and the results have seldom been so satisfactory, for price has usually had more influence than in the present case.

MUNICIPAL ENGINEERING has done its full share of preaching on the subject of professional ethics, and is ready to acknowledge the futility of its efforts in this direction when the scramble for employment leads so many of those, concerning whose technical ability there can be no question, to abandon the profession to its fate and reduce it even below the grade of the average bridge letting, which has at least a financial standing due to the great manufacturing plants owned or represented by the bidders.

The recommendations made at the beginning stand, however, as professional standards recommended by engineers not yet surrendered wholly to the commercial spirit, which may occasionally be attained when a city happens to have an engineer with some sense of professional propriety in whom it has enough confidence to follow his recommendations.

Books on Asphalt Construction.

I am employed by an asphalt company as foreman and have been for the past few years. As I am following this line of business, I would like to purchase some books that would be of benefit to me.

R. L., Chicago, Ill.

Richardson's "The Modern Asphalt Pavement" ($3) contains the fullest technical discussion of the manufacture of asphalt pavements and their properties. It is particularly authoritative regarding Trinidad asphalts and their use.

Peckham's "Solid Bitumens" ($5) is the latest book, and covers all classes of solid bitumens, but with particular reference to those that can be used in asphalt pavements.

Tillson's "Pavements and Paving Materials" ($5), Baker's "Roads and Pavements" ($5) and Byrne's "Highway Construction" ($5) have excellent chapters on asphalt pavements and their comparisons with other kinds of work.

Asphalt Chemists.

Please give me the names of leading asphalt paving experts and chemists in Chicago. I have heard some one quoted frequently as having a great reputation for successfully using California asphalt in paving mixtures.

B., ———, Pa.

The chemist in charge of the Chicago municipal asphalt laboratory is L. Kirschbraun. He has had much experience in the use of California and other asphalts in pavements in Omaha and Chicago, in particular, and may be the one referred to. Isaac Van Trump is the head of the Chicago branch of the New York testing laboratory of Clifford Richardson, which seems to make a special of Trinidad asphalt, but is experienced in all kinds.

The Chicago manufacturers of asphalt mixtures and pavements have practical and technical experts in charge of their

work. Their names will be found in the "Business Directory" published in each number of MUNICIPAL ENGINEERING, under the various "Asphalt" headings.

Dealers in Rock Asphalt.

Will you kindly give me list of names of firms handling rock asphalt, and very greatly oblige?

E. R. W., ———, Mich.

Foreign rock asphalts are handled by the Sicilian Asphalt Paving Co., 41 Park Row, New York city, and Gabriel & Schall, 205 Pearl street, New York city. American rock asphalts are handled by the Downard-Lester Co., Ardmore, Okla., and the Wadsworth Stone and Paving Co., Pittsburg, Pa.

Forms for Daily Force and Material Reports.

We have a population of 10,000. I want a daily street foreman's report that is simple and easily kept by an uneducated foreman and yet one that is comprehensive.

I enclose outlines that I have made out, but they don't just suit me. The quarry report fails to tell how far per hour the wagons travel. I have never seen just what, and don't know exactly what, I want, but it is more than likely you have on file just the thing I am looking for.

I want weekly and monthly reports deduced from the daily. Want them all in pads and also in book form for the office. S. H. R., Winchester, Ky.

The forms referred to are as follows:

DAILY REPORT OF STREET FOREMAN.

Headings of Columns—
- Col. 1—Laborers.
- Col. 2—Rate per hour.
- Col. 3—Cleaning Ditches, hours.
- Col. 4—Flushing Gutters, hours.
- Col. 5—Flushing Sewers, hours.
- Col. 6—Filling Ruts, hours.
- Col. 7—Cutting Weeds, hours.
- Col. 8—Spreading Macadam, hours.
- Col. 9—Rolling Macadam, hours.
- Col. 10—Oiling Streets, hours.
- Col. 11—Building Culverts, hours.
- Col. 12—Scraping Streets, hours.
- Col. 13—Repairing and Cleaning Culverts, hours.
- Col. 14—Building Bridges, hours.
- Col. 15—Repairing Bridges, hours.
- Cols. 16 to 22—Materials Used:
  - 16—Cement, Bags.
  - 17—Sand, Bushels.
  - 18—Stone, Loads.
  - 19—Dirt, Loads.
  - 20—*Tile, Lin. Feet.
  - 21—Lumber, Feet.
  - 22—Brick.
- Col. 23—Making Crossings.
- Col. 24—Street.
- Col. 25—Remarks.

*Sizes from 4 to 36 inches are specified in column.

DAILY REPORT FOR THE SOUTH PARK QUARRY.

Headings of Columns—
- Col. 1—Laborers.
- Col. 2—Rate per hour.
- Cols. 3 and 4—Stripping:
  - 3—Shoveling, hours.
  - 4—Picking, hours.
- Cols. 5 to 9—Quarrying:
  - 5—Bar, Pick and Shoveling, hours.
  - 6—Drilling, hours.
  - 7—Depth in Feet.
  - 8—No. of Power.
  - 9—Sticks of Dynamite.
- Col. 10—Feeding Crusher, hours.
- Col. 11—Engine Men, hours.
- Col. 12—Dump Men, hours.
- Cols. 13 to 15—Loads at Quarry:
  - 13—Rock.
  - 14—Spalls.
  - 15—Dirt.
- Cols. 16 to 18—Loads to City:
  - 16—Rock.
  - 17—Spalls.
  - 18—Dirt.
- Col. 1—Teams.
- Col. 2—Rate.
- Col. 3—Hours.
- Col. 4—No. of Loads to Dump.
- Col. 5—No. of Loads to Crusher.
- Col. 6—No. of Loads to City.

The above forms seem to be sufficiently detailed for all ordinary purposes, perhaps more so than the ordinary "uneducated foreman" will be able to handle. The report of material used is presumably not divisible among the various laborers whose names appear in the first column of the first blank, and for that reason, as well as because all the items can be arranged in a single column down the left hand side of a narrow page, with one other column for the amounts used to be entered, it would be easier for the "uneducated foreman" to have the report of material used on a separate sheet or on the back of the report of labor.

The quarry report might be improved likewise by putting all the reports of labor together, and putting the measurement of work done and materials used and product in a separate table, either on the same page or on the back of the sheet or on a separate sheet, as is most convenient. If a column is added to the report of teams, giving room for statements of place from which load is taken, then the clerk who compiles the reports can compute the distance each load is hauled and the total for the day.

Forms in use by others will be found in MUNICIPAL ENGINEERING, vol. xxx, p. 409, in an article on "Loose Leaf System for Field Notes and Office Records," also in vol. xxxvi, p. 1, in an article on "Cost Keeping on Municipal Contract Work." While the forms given in these articles will not suit our correspondent's needs exactly, he can get some help from the principles developed. Copies of these numbers can be supplied at 25 cents each.

Our readers are invited to send for publication forms for reports of such work which they have found convenient, both daily or weekly reports and weekly, monthly or annual summaries of the daily or weekly reports.

Information About Motor Driven Railway Cars.

I shall be interested to learn of any literature pertaining to the use of gasoline engines in the propulsion of cars for urban and interurban use. Any information on this subject will be appreciated.

A. W. K., Harvey, Ill.

W. R. McKeen, Jr., of Omaha, Neb., is probably as good authority on this sub-

ject as any. He will doubtless supply any desired literature. He has a good general discussion of the subject in the Proceedings of the New York Railroad Club for April 19, 1907.

W. F. Magruder has a paper on gas engines in railway work in the proceedings of the Central Railway Club for Jan. 8, 1904.

Philip Dawson has an article on the use of independent motor cars on railways in the Street Railway Journal for Nov. 6, 1904.

The Union Pacific motors are described in the Railway Age, March 10; the Automobile, April 1; the Railway Master Mechanic, August; Scientific American, Aug. 26; Railway and Engineering Review, Oct. 7, all in 1905.

Ordinance Controlling abatement of Nuisances and Assessing Cost.

Can you send me copy of ordinance providing for the abating of nuisances by the city and assessing of special tax bills against the property for the expense of such work. I refer particularly to filling stagnant ponds, removing dirt, snow and other obstructions on sidewalks.

S. W. H., Clayton, Mo.

In some States the Board of Health has charge of such work, in others the council or Board of Public Works, and in others the one or the other, according to the nature of the nuisance.

The following paragraphs from the ordinances of an Ohio city seem to cover the desired points, but the differences in State laws must be considered and modifications must be made in accordance therewith:

1. As to nuisances on private property:

All cellars, lots and parcels of land in the city, upon or in which pools of stagnant water may stand or collect, or which may be moist or wet, by means of defective drainage or otherwise, shall be drained or sewered by the person owning, controlling or occupying such cellar, lot or parcel of land, or in default thereof, after due notice so to do by the chief of police or health officer, the same may be sewered or drained by the city at the expense of such owner, controller or occupant.

Owner, occupant, lessee or other person having control of such premises, in addition to the penalty provided in this subdivision, shall be liable to said city for the cost of such abatement or removal, to be recovered in a civil action before any justice of the peace in the city, or other court having jurisdiction thereof.

2. As to cleaning sidewalks:

Every owner, occupant or person having charge of any tenement, building, lot or land fronting on any avenue, street, alley or other public highway of the city shall clear the whole sidewalk in front of said tenement, building, lot or land, of snow and ice before 9 o'clock of the forenoon of each day; provided, that if the sidewalk in front of said tenement, building, lot or land is not flagged or paved, a pathway thereon shall be cleared of ice and snow to the width of at least five feet; and if from any cause it shall be impossible to remove all the snow and ice which may adhere to such sidewalk, then every such owner, occupant or person having charge shall cover such snow or ice as shall so remain with such coating of ashes, sand or other substance as may be necessary to render travel safe and convenient. Every owner, occupant or person having charge of any tenement, building, lot or land fronting upon any avenue, street, alley or other public highway of the city shall keep the entire width of said sidewalk, from curb to lot line, free and clear of all earth, sand, brick, stone, rubbish, dead trees and dead branches of trees or other material which from any cause whatever shall have accumulated or may accumulate upon said sidewalk above the established grade of the same, and shall also cut and remove from the sidewalk between the lot and curb line all weeds, grass and vegetable growths that are more than four inches in height. If the owner of any building, lot or land fails to comply with the provisions of this ordinance, then the Board of Public Service may remove the snow, ice, earth, sand, brick, stone, rubbish, dead trees or other materials, weeds, grass and vegetable growths from the sidewalk in front of the premises of such owner, and may charge the expense thereof to such owner, and if upon being notified, he fails to pay the city the amount of such expense, then said amount may be certified by the proper city officer to the county auditor, and the same shall act as a lien upon the property of such owner, and shall be collected as provided for in the case of special assessments.

The ordinance in a Michigan city provides that if the owner fails to remove the obstructions the Board of Public Works removes them and collects the cost in the same way that assessments for sidewalk repairs are collected.

The above ordinances are rather cumbersome in form and could be improved in that regard at the same time that they are being changed to suit the laws in Missouri.

Dangerous Building Within Fire Limits.

I want information concerning restriction and removal of dangerous buildings within fire limits.

M. S. M., Madison, Neb.

Ordinances in Cincinnati, O., and Dubuque, Ia., are quote in MUNICIPAL ENGINEERING, vol. xxxvii, p. 184, and additional information is there given about the methods in Indianapolis, Baltimore, Cleveland, St. Louis, San Francisco, Chicago, Detroit, New Orleans, Toronto, Wisconsin cities, and Washington, D. C.

The city of Atlanta, Ga., provides that "whenever any frame building within the fire limits shall have become damaged by fire or decay, the extent of which, in the judgment of the inspector of buildings, exceeds 50 per cent of the value of such building, it shall be condemned by the inspector of buildings, and it shall be unlawful to repair the same." Provision is made for appeal to the chief of the fire department and the city engineer if the property owner is not satisfied with the decision of the building inspector.

Other sections provide that "every building which shall appear to the inspector to be especially dangerous in case of

fire, by reason of bad condition of walls, overloaded floors, defective construction, decay or other causes, shall be held to be unsafe; and the inspector shall notify the owner to cause the same to be made safe and secure or taken down; and when public safety requires immediate action, the inspector may enter upon the premises, with such assistants as may be necessary, and cause the said structure to be secured or taken down without delay, at the expense of such owner or party interested. The inspector "shall also affix a notice of the dangerous character of the structure to a conspicuous place on the exterior wall of said building; any person removing such notice so affixed, shall be liable to a fine of not less than $10, nor more than $50 for each and every offense, to be paid into the treasury of said city. The owner or party having an interest in the unsafe building or structure, being notified thereof in writing by the inspector, shall forfeit and pay a fine to the use of said city for every day's continuance thereof after such notice, a sum of not less than $10 nor more than $50.

Another section names the trades which shall not be carried on in buildings within the fire limits, and the conditions under which, only, some can be carried on.

The general penalty of not more than $100 is fixed for the violation of any section of the building ordinance.

These provisons seem to cover all parts of the question as completely as any ordinance with which the writer is acquainted.

City's Right to Remove Public Nuisance.

The case of Nerio v. Maestretti (Cal.), 98 P. 860 was cited in the legal department of the MUNICIPAL ENGINEERING Magazine in deciding that "the continued occupation by one of a portion of a public street by maintaining a house thereon is a continuance of a nuisance created by the obstruction which under civil code Sec 3490 can not by lapse of time be legalized, and the public officers charged with removing obstructions from streets may remove the same on the refusal of the owner to do so." Please give me the reasons assigned by the court in the determination of this case.

SUBSCRIBER, ———, Ohio.

In this case plaintiffs had erected houses upon a part of a public street of the city and county of San Francisco. The board of works had given notice to the plaintiffs to remove these structures and abate the nuisance created by them. Upon plaintiffs' failure and refusal to do so they entered and proceeded to remove the obstructions. Plaintiffs' action was to enjoin the board of works from alleged unlawful interference with their property.

The court said that "under the laws of the state of California the board of works was charged with the duty of removing obstructions from the public streets of the city and county," and that the appeal was entirely without merit. No further reasons were assigned, but an examination of the Civil Code of California shows that the decision is wholly statutory. Section 3479, in defining a nuisance, includes any "obstruction to the free passage or use of property, so as to * * * unlawfully obstruct the free passage or use, in the customary manner of any navigable lake, or river, bay, stream, canal or basin, or any park, square, street or highway."

The court's opinion that it was the duty of the board of public works to abate the nuisance is undoubtedly based upon section 3494 which, says: "A public nuisance may be abated by any public body or officer authorized thereto by law." The board of public works would have jurisdiction over the streets in the exercise of their powers and duties under the California statutes.

The court's opinion that a nuisance could not be legalized by a continuous occupation was based upon section 3490, which says: "No lapse of time can legalize a public nuisance, amounting to an actual obstruction of a public right."

Simple Tests of Cement.

Will you be kind enough to inform me of some simple formula for testing cement without a chemical analysis being made?

J. F. NOLL, Harrisonburg, Va.

A chemical examination is seldom necessary for testing cement. No one who is not prepared for full testing and examination of cement or for paying an established laboratory for that work should attempt to use a cement which has not yet proved its quality. Every one should make at least the rough tests for the condition of the cement delivered, no matter what the excellence of the reputation of the cement may be. There are accidents which may happen to the cement on the way from the factory, substitutions and mixtures which can be detected by some of the short tests and which may be injurious to the work if they are not detected in time.

Such tests, as well as the standard detailed tests and examinations are given in the Hand Book for Cement Users ($3). They will also be found in the following numbers of MUNICIPAL ENGINEERING and others: Vol. xxxiv, p. 233; xxxiii, p. 415; xxviii, p. 458. These numbers can be supplied for 25 cents each.

Material for City Beautiful Campaign.

Will you send me literature or any information you may have relative to the "beauty campaign" carried on in Dayton, O., by the National Cash Register Company?

Any descriptions of what was accomplished there in improving the yards, gardens and general appearance of the city, or any account of similar work done elsewhere, will be greatly appreciated.

E. V. P., Spokane, Wash.

The National Cash Register Company has published much material of this sort

some of which can doubtless be obtained upon application to its office in Dayton, O., together with references to many magazine articles concerning its work.

Reference should be made to the standard indexes to periodical literature, such as Poole's Index, which can be consulted at almost any public library, for names and dates of articles upon the work done in other places.

There are many special publications by city organizations and by architects, showing what has been planned by the cities. Charles Mulford Robinson, Rochester, N. Y., and John Nolen, Cambridge, Mass., are two who have prepared the largest numbers of such reports. Doubtless some of them can be obtained from them by correspondence.

Among Mr . Robinson's reports are those on San Jose, Oakland, and Los Angeles, Cal.; Denver, Col.; Cedar Rapids, Iowa; Ft. Wayne, Ind., and Ridgewood, N. J.

Mr. Nolen has reported upon San Diego, Cal.; Reading, Pa., and several others.

Kelsey and Guild of Boston, Mass., have reported on Greenville and Columbia, S. C.

D. H. Burnham, Chicago, Ill., has reported alone and with others on Washington, Chicago, Cleveland, San Francisco and others.

The Civic League of St. Louis, Mo., has published a number of books and pamphlets on city plan, playgrounds, billboard advertising, the smoke nuisance, city lighting, etc.

Hartford, Conn., Municipal Art Society, New York City Art Commission, New York Municipal Art Society, American Civic Association, with headquarters in Washington, D. C.; the National Municipal League, North American Building, Philadelphia, Pa., are organizations with publications upon all phases of the question of making the city beautiful.

Philadelphia, Pittsburg, Indianapolis, Memphis, St. Paul, Madison, Wis.; Spokane, Louisville, Boston, Buffalo, Montreal, Seattle, Harrisburg, Ottawa, Detroit, Baltimore, Columbus, O.; Colorado Springs, Syracuse, Kansas City, Minneapolis, Duluth, Springfield, Mass.; Ogdensburg, New Orleans, Atlantic City, Providence are other cities, large and small, which have more or less elaborate plans concerning which more or less has been published, some of them having made a good start in the construction.

FROM WORKERS IN THE FIELD

Practical Points from Practical People.

Contributions to this Department are invited. Give from your experience for the benefit of others. No matter about the style of the composition, the fact is what is wanted. Use the Question Department for what you want to know; use this Department for what you can tell others.

Effect of Length and Irregular Profile on Suction Line of Pumps.

To the Editor of MUNICIPAL ENGINEERING:

Sir—A suggestion on "Effect of Length and Irregular Profile on Suction Line of Pump," on p. 182 of Question Department for March.

Referring to the editor's figures, which I have checked and endorse, I will offer for consideration the following further analysis: The two downward legs of the siphon aggregate not more than five feet. These being on grade sufficient to carry the required amount of water down their slope at much less than the full pipe, so soon as sufficient air is accumulated to fill the top of the down leg of pipe the water will run as a stream in the bottom, sustained by the friction of its speed, as in any stream, and the effect which was realized when the pipe was full, of this leg of pipe acting as a counterpoise against so much of the rising leg of the siphon, is lost. The total rises in the pipe, therefore, must be sustained by suction at the pump (atmospheric pressure). The rises aggregate six feet about. This added to the nine feet of frictional, etc., resistances makes a total of about fifteen feet that must be sustained at the pump. Add to this, as stated, 50 per cent increased resistance with age, or, say, five feet, we now have a total of twenty feet as the limit of resistance, which is still an easy proposition when the pump is filled with water.

As, then, these summits are safely below the possibility of forming an actual air leak and the question is to handle the accumulated air to save the pump from shock and unpriming, allow me to suggest the feasibility, and as the summits are quite distant, the probable great convenience of having some adopted form of standpipe and good suction pump in the

line at the pump house for extracting what free air may come. This would take care of not only the accumulation drawn from the summits from time to time, but also of any further air occluded during the long passage from there to the pump, and insure the pump solid water.

C. E. V., East Palestine, O.

Large Water Tanks.

In reply to the inquiry in the February number of MUNICIPAL ENGINEERING, vol. xxxviii, p. 112, for the location of very large water tanks, the following information has been gathered:

Simpson Brothers Corporation, Boston, Mass., send data for a reinforced concrete reservoir at Waltham, Mass., Bertram Brewer, City Engineer, stating that the inside height of the reservoir is 40 feet, the diameter is 100 feet, the walls at the base are 18 inches thick and at the top 12 inches, and the capacity is over 2,000,000 gallons. It was constructed in 1908, has had no repairs and is in perfect condition.

A 9,000,000 gallon tank, 321 feet square and 16 feet deep, top 110 feet above ground, supported on 81 steel columns, is proposed for the city of Calcutta, India, but not yet built.

Large tanks supported on towers which are in successful use are the 300,000 gallon tank in Ft. Snelling, Minn., 131 feet high; the 200,000 gallon tank at Louisville, Ky., 220 feet high; the 185,000 gallon tank at Vineland, N. J., 120 feet high.

Electrically Driven Pumps for Water Works.

To the Editor of MUNICIPAL ENGINEERING:

Sir: In regard to the feasibility of electrically driven pumps, I would say in answer to P., ———, Mich., on p. 185, of the March number, that the maximum efficiency and economy can be derived from direct connected pumping machines.

A volute pump, having synchronous motion, 25 cycle alternating current, is simple, durable and highly efficient. There are several such built in this country, foremost among which are the Allis-Chalmers and other reliable types. I have found much reliability in the Worthington pumps, built by Henry R. Worthington Company. Philadelphia, Pa. I have installed these for displacing steam pumps, with 2,200 to 4,000 volts and as low as 220 volts for effecting reduction of operating costs over that of steam systems.

WM. P. SLIFER,
Pittsburg, Pa.

CURRENT INFORMATION

Boston's Mayor Asks Help—Testing Meters—Taxing City Property—Street Railway Assessment—Foreign Cement Trade—Rapid Transit in New York—Ohio Sewage Purification—Massachusetts Municipal Reports—Police Department Methods—Sewage Disposal for New York—Highway Bridges

Boston's New Mayor to the Bureau of Municipal Research.

The new Mayor of Boston under the new charter recognizes the good work of the Bureau of Municipal Research in New York by the following letter:

As you are probably aware, the city of Boston has just entered upon its first administration under an amended city charter and a four year mayoralty term; a great deal of reorganization and readjustment seems to be necessary or advisable. I think that our city officials, as well as our citizens generally, realize the importance of making the first steps now to be taken of a sound and constructive character, to the end that the different departments and authorities of our city government may be able to co-operate harmoniously toward securing a better and more efficiently governed Boston which we are all aiming for.

As mayor of the city I should like very much to have an opportunity for a conference with one of the directors of the Bureau of Municipal Research as soon as possible, as to the experience of your Bureau in analyzing the elements of similar municipal problems in New York and other cities; I would like more especially to be fully informed as to the constructive measures and methods that are being installed and tested under the advice of your Bureau in other cities.

Would it be possible for one of your directors to come to Boston for this purpose, preferably on Tuesday, March 15th, for a conference with me, at which city officials and city books could be within easy access? I should expect to reimburse your Bureau for such charges as may be necessary for this purpose, and can assure you that Boston's officials would appreciate such co-operation as you may nd it possible to give.

In case of your acceptance of this invitation, I trust that it may be possible for your representative to devote at least

two days in Boston to conferences and explanations which I will arrange.

Proposed New Jersey Law Governing Tests of Light Meters.

A bill was introduced in the New Jersey legislature, March 7, which would give the governing body of any city in New Jersey authority to appoint an inspector or inspectors of gas and electric meters, whose duty it will be to examine, prove and ascertain the accuracy of any and all gas and electric meters used for measuring or ascertaining the quantity of illuminating or fuel gas or electricity furnished by any corporation. The bill provides that any consumer of gas or electricity may request an inspector in writing to inspect the meter, but before having this done the applicant must deposit a fee, to be uniform in each case, the amount of which shall be taxed by the governing body. If, on examination, the meter shall be found to be five or more per cent. defective or incorrect, the inspector shall order the corporation forthwith to remove the meter and place instead thereof a correct measuring device. The expense of such inspection and test shall be borne by the corporation if the meter is found defective. In case the meter is found correct, the cost of the test shall be paid by the consumer. The inspectors are required to make periodical tests to ascertain the quality of the illuminating gas and the record of the result of such test must be filed, and be open to public inspection. In the event of a public utility commission law being enacted to include work similar to that provided in this bill, the passage of the measure will not be pressed.

Bill to Tax Municipal Real Estate in Other Taxing Districts.

A bill was introduced in the New Jersey legislature, March 7, which provides that the real estate of the counties and municipalities of the state, used for the purpose of public water supply, shall be subject to taxation by the taxing district in which it is located. The bill differs from the Wright law of 1906, which was declared unconstitutional by the supreme court, in that it calls for taxation on municipal property used for water supply purposes. The Wright law would have taxed all municipal property, whether used or unused, or whatever the usage.

The Cement Trade with Foreign Countries.

The imports of foreign cements into the United States have been dropping off at a very rapid rate in the past two years. In 1907 they were 2,111,819 barrels of 380 pounds, somewhat more than for a few previous years, but in 1908 they dropped to 883,418 barrels, and in 1909 to 454,510 barrels, the lowest figure in the published history of the industry.

The decrease in imports has been most pronounced in the trade with Great Britain, from which we imported only one-twentieth as much last year as in 1907; Belgium, which is reduced to one-fifth in the three years; Germany, reduced to one-fourth. The imports from France remain steadily about 40,000 barrels a year. The imports from Canada are fifty times as much as in 1907, now amounting to about 500,000 barrels a year.

The exports of cement seem to have increased from 900,550 barrels in 1907, and 846,785 in 1908, to 1,056,922 in 1909, but when the exports to Panama are deducted as being hardly foreign trade, the exports have really diminished about 200,000 barrels in the three years, for in 1907 Panama took only 82,569 barrels, and 75,666 in 1908, while the consumption on the canal in 1909 jumped to 438,876 barrels, as shown by the custom house records. Three-fourths of the last named amount was imported in the last six months of the year.

Street Railway Must Pay Paving Assessment.

The Mississippi supreme court declared invalid, March 14, the exemption from the expense of street paving claimed by the Jackson Electric Railway Company. Justice Mayes, who handed down the opinion, holds that the aldermanic body has no right to sign away an exemption of this nature.

History of Rapid Transit in New York City.

The Public Service Commission for New York City has printed separately Appendix A of its report for 1909, giving a history and description of rapid transit routes in New York City adopted under the rapid transit act, embracing routes constructed, under construction and validated for construction, together with a map of each route and a combination map showing all such routes, also routes laid out but not validated as yet.

Sewage Purification and Stream Pollution in Ohio.

The quarterly bulletin of the Ohio State Board of Health for the last quarter of 1909 contains a preliminary report on an investigation of the condition of the Ohio river as regards pollution and its effects, made by Burgess, Kimberly & Long, consulting engineers at Columbus, O., for the Ohio River Sanitary Commission.

The conclusion reached is that the river at no point is safe and satisfactory in its raw state for drinking purposes, and that filtration only will purify it beyond question.

The bulletin also contains a report of an investigation of the efficiency of the Dayton electrolytic cell for the disinfection of water and sewage, made in the Board's laboratories. The cell is made to produce a weak solution of sodium hypochlorite for laundry purposes and the tests were made at the request of the secretary of the Board to determine whether it

would be efficient for sterilizing water and sewage. The conclusion is that it does not equal in economy the use of chloride of lime for the same purpose where it is possible to use that chemical.

Uniform Municipal Reports in Massachusetts.

The Bureau of Statistics of Massachusetts, Charles F. Gettemy, director, has issued Municipal Bulletin No. 1 in accordance with an act of the last legislature whereby the duty is imposed on him of prescribing forms or schedules for uniform annual returns, giving detailed classified receipts and payments, debts, assets and liabilities for cities and towns.

The bulletin follows the statutes which have been passed from time to time regarding the legitimate operations of municipalities, and thoroughly analyzes and classifies them, with references to act and section. With each item is given an explanation of the entries which must be made under it, so that the municipal accounting officer can find out exactly where to put every sum representing a receipt or expenditure, and just how to make the balance sheet for his corporation.

The bulletin is an excellent text book on municipal accounting, even if its forms are restricted to those in use in Massachusetts.

Sewage Disposal for New York City.

The Metropolitan Sewerage Commission of New York has published a "Digest of Data Collected Before the Year 1908," and a preliminary report, dated March 1, 1910, in which it gives a brief statement of the progress of the work, the program followed and the conditions found. It recommends an interstate commission established by the coordinate action of the legislatures of New York and New Jersey, confirmed by the U. S. Congress, which shall have control of the problems, which are now rapidly becoming serious.

The report answers the specific questions asked by the legislature, to the effect that the problem is too large for the 80 or more municipalities interested to take care of by any attempt to procure an inter-city agreement; that sedimentation, screening, filtration and sterilization and their modifications are the methods of purification most worthy of consideration; that a sewerage district of about 700 square miles, half in each state, would be required to cover all the problems of conservancy of the sanitary condition of the harbor; and that the best system of administrative control would be the interstate sewerage commission.

The recommendations are a commission of the city of New York, or the state, to which all questions of sewerage in the New York part of the district must be referred, for treatment of the New York problems until such time as the co-operation of New Jersey can be secured.

Modern Highway Bridges.

The Illinois State Highway Commission, A. N. Johnson, state engineer, has published a pamphlet on "Modern Bridges for Illinois Highways," which gives information about the work of the commission in giving free advice on formal request of county, municipal and township authorities, and instructions as to the procedure to be followed to secure this advice. The booklet also contains 26 plates of photographs, with instructions, showing poor methods of construction and the better methods which should replace them.

Police Department Methods.

The business methods of New York City's police department are the subject of a 212-page publication of the Bureau of Municipal Research, price $1. It contains a critical study and constructive suggestions pertaining to administrative and accounting methods of the Bureau of Repairs and Supplies, based upon an inquiry requested by Police Commissioner Bingham in July, 1908, and pursued from August, 1908, to April, 1909, with the co-operation of Wm. T. Baker, then first deputy and now police commissioner.

ORGANIZATIONS AND INDIVIDUALS

Government Testing Laboratory—Technical Schools—Civil Service—Standardizing Paving Specifications—Technical Meetings—Personal Notes

Government Tests of Fuels, Structural Materials and Mine Accidents.

At the regular monthly meeting of the Engineers' Society of Western Pennsylvania, Feb. 15, Elmer K. Hiles was reelected secretary for the ensuing year.

A paper on "The Government Testing Station in Pittsburg" was presented by Mr. J. C. Roberts, assistant chief engineer, Technologic Branch, U. S. Geological Survey. Lantern slides were shown, illustrating apparatus in use at the station,

and a very illuminating description of the work accomplished, as well as that to be taken up in connection with the testing of structural materials, fuels and the causes and prevention of mine accidents was given.

Up to the present time the work with structural materials has been confined to reinforced concrete and the constituent material of concrete, and to the testing of various clay products in the Clay Products Bureau.

During 1910 it is expected that a 10,000,000-pound testing machine will be installed, capable of testing 65-foot full-size section columns, etc.

In the fuel investigations, most of the coals from the various districts have been tested under boilers and in gas producers, and various liquid fuels have been investigated. Much work has been done with briquetting coals. Investigations have been made along the line of the waste of coal, the conservative estimate being made that 200,000,000 tons of coal are wasted annually by being thrown on the culm banks, or left in the mine in pillars and otherwise. The gas producer investigations have demonstrated that highly efficient results can be obtained with the roof coal, bone coal, etc., that is usually wasted. When firing the producer with washer refuse, carrying 68 per cent ash, full load has been carried on the gas engine.

Much work has been accomplished in connection with the investigations of the causes and prevention of mine accidents. The loss of 3,000 to 4,000 lives yearly in the United States indicates the importance of this work.

Explosives are tested and the station has established a list of "permissible explosives" for use in coal mines.

Safety lamps are tested under every possible circumstance of use, as well as the various types of rescue apparatus. In the rescue and training stations now in operation at Pittsburg, Urbana, Ill., Knoxville, Tenn., McAllister, Okla., and Seattle, Wash., training classes are established to educate the miners in the use of rescue apparatus, and the operators are urged to send picked men to attend these classes and to establish local rescue stations in the vicinity of their mines.

The Technical Schools.

Engineering Bulletin No. 1 of the University of Kansas, at Lawrence, contains papers on "A Ballistic Electro Dynamometer Method of Measuring Hysteresis Loss in Iron," by Martin E. Rice and Burton McCollum, and "Voltage Regulation of Alternators," by Mr. McCollum.

"A Study of Base and Bearing Plates for Columns and Beams," by N. Clifford Ricker, forms the subject of Bulletin 35 of the Engineering Experiment Station of the University of Illinois. Formulas giving the safe load for steel and cast-iron plates of the usual forms are set forth and a series of tables makes the designing of such plates a very simple matter.

"The Thermal Conductivity of Fire Clay at High Temperatures," by J. K. Clement and W. L. Egy, issued as Bulletin No. 36 of the Engineering Experiment Station, University of Illinois, is a report of the results of experiments on the thermal conductivity of several commercial fire clays at high temperatures. A detailed description of the instruments and methods of high temperature measurements is included.

The Clarkson Bulletin, Potsdam, N. Y., has the Founder's day address of Prof. I. N. Hollis on "Training Men for the Industries and the Advancement of Science," and articles on the turbine wheel, Halley's comet and the sanitary examination of water. At the Charter day exercises, March 18, Charles P. Steinmetz, of Schenectady, N. Y., delivered an address on "The Industrial Use of Luminescence."

Civil Service Examinations.

The U. S. Civil Service Commission will hold examinations at the usual places as follows:

April 20: Engineer in wood preservation, district No. 2, Forest Service, at $1,300 a year.

May 4: Two laboratory aids and engineers in Forest Products Laboratory, Madison, Wis., at $900 a year.

Committees of the Organization of City Officials for Standardizing Paving Specifications.

The following standing committees have been appointed to consider the subjects assigned to them and make reports at the convention to be held in New York in January, 1911. Undoubtedly they will be glad to hear from all city officials interested in the respective subjects.

Asphalt—Geo. W. Craig, chairman, Omaha; Wm. R. Benson, vice-chairman, Philadelphia; Chas. E. P. Babcock, Buffalo; Lester Kirschbraun, Chicago; George W. Tonson, Toledo.

Bituminous Concrete—Linn White, chairman, Chicago; L. W. Rundlett, vice-chairman, St. Paul; L. W. Anderson, Grand Rapids; J. P. Sherer, Milwaukee; Geo. F. McConagle, Salt Lake City.

Bonds, Guarantees and Uniform Bidding Blanks—W. J. Hardee, chairman, New Orleans; H. C. Allen, vice-chairman, Syracuse; George H. Norton, Buffalo; B. T. Goodnow, Kansas City; Charles A. V. Standish, Chicago.

Concrete—J. H. Weatherford, chairman, Memphis; Abram Swan, Jr., vice-chairman, Trenton; N. E. Murray, Chicago; L. A. Jansen, Milwaukee; Otto H. Klein, New York.

Creosoted Block—George W. Tillson, chairman, New York; Andrew Rinker, vice-chairman, Minneapolis; Albert F. Keeney, Pittsburg; N. S. Sprague, Pittsburg; J. C. Travilla, St. Louis.

Macadam—J. L. Darnell, chairman,

Kansas City; Wm. H. Brooks, vice-chairman, Philadelphia; Walter J. Leininger, Chicago; H. W. Klausman, Indianapolis.

Stone Block—B. T. Fendall, chairman, Baltimore; George S. Smith, vice-chairman, New Orleans; Morris R. Sherrerd, Newark; John Minwegen, Chicago; M. F. McKenna, Bridgeport.

Vitrified Brick—Edward H. Christ, chairman, Grand Rapids; D. M. Roberts, vice-chairman, Terre Haute; Henry Maetzel, Columbus; John B. Hittell, Chicago; W. K. Seitz, St. Joseph.

Publication—Felix A. Norden, chairman, Chicago; A. C. Kugle, vice-chairman, Omaha; C. D. Hill, Chicago; Thos. P. Wriggins, Trenton; John C. Ely, Dayton.

Technical Meetings.

The next annual convention of the National Electric Light Association will be held in St. Louis, Mo., May 23 to 28.

At the regular meeting of the Canadian Society of Civil Engineers, held in Montreal, March 17, H. B. Lordly presented a paper on "Subaqueous Concrete Work," and W. H. Breithaupt one on "Grade Separation."

The annual convention of the American Water Works Association will be held at New Orleans, La., April 26, 27, 28, 29 and 30. J. M. Diven, secretary, 14 George street, Charleston, S. C. The program has not been received at the time of going to press.

The annual meeting of the Appalachian Engineering Association will be held at Winston-Salem, N. C., May 6 and 7. Henry M. Page, secretary, Morgantown, W. Va.

The Ohio Society of Mechanical, Electrical and Steam Engineers will hold its semi-annual meeting at Cincinnati, Ohio, May 19 and 20. F. E. Sanborn, secretary, Ohio State University, Columbus, O.

The regular monthly meeting of the New England Water Works Association was held in Boston, March 9. A paper entitled "Double Filtration of Polluted Water" was read by Henry W. Clark, chemist of the Massachusetts State Board of Health. The Board has carried on experiments on double filtration since 1893. Double filtration has been many times proposed for highly polluted water and also for overcoming large growths of algae and similar microscopic organisms. Experiments have been carried on by filtering the Lawrence city water, which has already passed through the city filter; also by double filtration of the Merrimac river water, and of other water much more highly polluted than that. The average results were shown by tables projected upon the screen and indicated that double filtration has no advantage either in bacterial efficiency or in economy in cost of scraping and caring for filters, over single filtration at a reasonable rate, in the case of these waters.

A meeting of the American Institute of Electrical Engineers will be held in Charlotte, N. C., March 30 to April 1.

The next meeting of the Northwestern Clay Association will be held in Minneapolis, Minn., April 6. Alex Anderson, secretary, Minneapolis.

The annual convention of the Illinois Mayors' Association will be held at Cairo, Ill., May 18 and 19. The program will embrace a number of interesting papers on various subjects.

The annual convention of the Illinois Water Supply Association, which was organized in 1909, was held at the University of Illinois (Urbana and Champaign), March 8 and 9. Among the papers presented were the following: "Experience with Deep Well Pumps," F. C. Amsbary; "The Chances of Pollution in Shallow Wells," C. B. Burdick; "The Rate of Flow of Water Into Wells," Prof. A. N. Talbot; "A City Water Supply From Wells," O. T. Smith; "Filtration of Water Supplies," J. Langdon Pearse; "Disinfection of Water," Prof. C. E. A. Winslow; "The Practice and Devices Used in Applying Hypochlorite," H. E. Jerclau; "Bleaching Powder as an Adjunct to Filtration at Quincy, Ill.," W. R. Geiston; "The Quality of the Waters of the Mississippi System," R. B. Dole; "The Significance of the Term Alkalinity in Water Analysis," Prof. E. W. Washburn; "Legislation in Relation to the Pollution of Streams," H. M. Ely; "Water Supplies and Typhoid Fever in Illinois," Dr. Bartow; "The Action of Mississippi Water on Metals," W. F. Montfort; "The Sanitary Conditions of Water in Inlet Tunnels," T. A. Alvord and L. I. Birdsall; "Shall Water Companies Furnish the Private Services Free, Up to and Including Meters?" E. P. Wheeler; "Water Works Franchises," Prof. M. H. Robinson; "A State Bureau of Municipal Information," Prof. J. W. Garner. Officers were elected as follows: President, C. E. Slocum; vice-presidents, O. T. Smith, R. R. Perkins and C. H. Cobb; secretary and treasurer, Dr. Edward Bartow.

The second National Conference on City Planning will be held in Rochester, N. Y., May 2 to 4. The general subject for consideration is "The Problems of Congestion," with many speakers on Tuesday, the 3d, upon the causes and prevention of congestion of population; on Wednesday morning, the 4th, upon the circulation of passengers and freight in its relation to the city plan, and on Wednesday afternoon upon legal and administrative procedure affecting the city plan. There will be an exhibit of city planning and congestion. The entertainment features include automobile tours of the city, a luncheon on Monday and a banquet Tuesday night.

The Cement Products Exhibition Company has had such phenomenal success with the Chicago Cement Show and has had so many requests for a similar exhibition in New York, that it has leased Madison Square Garden from about December

14 to December 20, 1910, and will then hold a great educational show to promote the cement industry in all its branches. It is not believed that the New York show will interfere in the least with the Chicago show. Many exhibitors at the latter have already expressed their intention to exhibit at the New York show.

The American Academy of Political and Social Science will shortly publish a special volume on "Public Recreation Facilities," including parks and playgrounds. This is one of six such special volumes issued to members last year. Eight such volumes have been issued, treating of conservation, city, race, business, industrial and territorial conditions. Three are in preparation for early issue, the other two being on stocks as investments and the administration of justice in the United States.

Secretary J. M. Diven, Charleston, S. C., has published the proceedings of the 29th annual convention of the American Water Works Association, held at Milwaukee, Wis., June 7 to 12, 1909. The volume contains 796 pages and many inserts. The papers are specially full on the subjects of water purification and the boiler-room, but nearly every problem of the water works man has at least one discussion in a paper or otherwise.

The report of the 19th annual meeting of the Massachusetts State Board of Trade contains an address by Charles W. Eliot, ex-president of Harvard College, upon "The Complete Revolution in Business," which shows the modern necessity of an engineering education in most lines of business and, perhaps, will suggest why engineering is becoming each day more of a business and less of a profession, even to some extent in those lines which have been considered strictly professional.

The Bureau of Municipal Research of Philadelphia has been organized under the general supervision of the New York organization with two directors and six assistants. A booklet giving a brief description and a full classification of the work which it is proposed to do has been issued under the title of "Business Methods in Public Business."

The Cincinnati Bureau of Municipal Research, Rufus E. Miles, director, Neave building, has published Paving Report No. 1, relating to wood block paving contracts, being a brief submitted to the Board of Control of the city. It gives a history of the peculiar methods of letting contracts for wood block pavements in 1909, a discussion of the specifications for creosote oil and the adherence thereto. Accompanying is the reply of the Director of Public Service and the reply of Director Miles of the Bureau of Municipal Research thereto, which throw some additional light on the situation, which is not creditable to the city of Cincinnati.

The latest bulletins of the Museum of Safety and Sanitation, 29 West 39th street, New York, give descriptions of linemen's protective shields and guards for window cleaners.

The Civic League of St. Louis, Mo., publishes in attractive form the report of its signs and billboards committee on "Billboard Advertising in St. Louis," showing its atrocities and how they can be abated. The league has recently received much encouragement in its campaign through a decision of the State Supreme Court confirming to the city the right to control billboards by the ordinance passed and under attack.

At the meeting of the Brooklyn Engineers' Club held March 10, W. W. Brush presented a paper on "The Proposed Delivery System for Catskill Water Within the City Limits." The annual smoker of the club will be held at the Imperial restaurant April 7.

At the meeting of the Municipal Engineers of the City of New York, March 23, Alexander Johnson presented an illustrated paper on the Manhattan bridge. An inspection of the Madison avenue bridge over the Harlem river was made March 26.

S. E. Doane, chief engineer of the National Electric Lamp Association, delivered an illustrated lecture in Colonial Hall, Fremont, O., on March 23, before the Electric Light Association.

The American Society of Engineering Contractors has sent out ballots for a new annual election of officers and called an annual meeting for April 12 in New York.

Personal Notes.

W. S. Hill has been elected mayor at Muscatine, Iowa.

H. H. Tracy has been appointed city engineer at Norfolk, Neb.

S. Cameron Corson has been re-elected city engineer at Norristown, Pa.

John M. Dortch, city engineer of Shreveport, La., for four years, died March 1.

Frederick Schafer has resigned as superintendent of water works at South Bend, Ind.

Hon. Charles Scheerer, mayor of Galena, Ill., died suddenly of apoplexy, March 14.

Harry W. Walker has resigned as secretary of the New York Aqueduct Commission.

Hon. William L. Shurtleff, mayor of Cuba, Ill., died March 15 at Moline, Ill., aged 42 years.

William P. Hennessey has resigned as principal assistant engineer of the Borough of the Bronx, New York.

Hudson F. Layton, civil and consulting engineer, has removed his office to 2501 Oliver Building, Pittsburg, Pa.

Lewis W. Anderson has resigned as city engineer of Grand Rapids, Mich., which position he has held for ten years.

David Sloan has been appointed consulting engineer and W. G. Sloan chief engineer of MacArthur Brothers Company.

Hudson F. Layton, civil and consulting engineer, will move, April 1, to suite 2501 Henry W. Oliver Building, Pittsburg, Pa.

H. C. Kittredge, Assoc. M. Am. Soc. C. E., formerly with the American Pipe & Construction Company, of Philadelphia, Pa., and Knight & Hopkins, of Rome, N. Y., have established offices at 42 Werner Park, Rochester, N. Y., and will practice

as designing and consulting engineers on the construction of plain and reinforced concrete structures.

W. M. Bostaple has been elected city engineer at Ogden, Utah, to succeed A. F. Parker, who resigned recently to engage in private practice.

Alexander S. Farmer and William E. Brown have been appointed assistant engineers and designers under the Board of Water Supply, New York City.

James Bell, who has been city engineer at Ft. Thomas, Ont., for 2 years, has resigned. His resignation will not become effective until the end of the year.

H. P. McCabe has been elected president, H. H. Bailey clerk, J. E. Kennedy treasurer, and D. F. Ahearn, J. E. Neaton and Thomas F. Ryan, trustees, at Emmett, Mich.

Walter B. Snow, publicity engineer, rooms 421 to 425, 170 Summer st., Boston, Mass., has largely increased his force and office facilities to accommodate his increasing business.

Henry Maurer has been elected village president, Charles Faymire clerk, Eugene Bartlett treasurer, and Thomas W. McCall, Jacob Mesic and Anson Welch trustees, at Memphis, Mich.

Major Jay J. Morrow, Corps of Engineers, has been relieved of duty in charge of the water supply system of the District of Columbia, and of the improvement of the Potomac river, and assigned to duty at Portland, Ore., in charge of river and harbor improvements in the engineering district, including the territory of Alaska. Major Morrow is succeeded temporarily by Capt. Warren T. Hammon, who has been his principal assistant.

Dr. J. H. Dancey has been elected village president at Capac, Mich. Frank Bent was elected clerk, Frank Bench treasurer, and D. A. McDougall, O. A. Prey and Charles Lang, councilmen.

Harry B. Gunnis has been elected village president, John H. Ihuken clerk, Delancy A. Pontius treasurer, and John M. Druillard, Asa C. Jackson and Charles T. Worthy, trustees, at Algonac, Mich.

S. D. Newton has retired from the office of city engineer of Knoxville, Tenn., and has opened offices as a civil and consulting engineer, making a specialty of municipal work, and also of reinforced concrete structures.

W. Waldo, consulting engineer, has established new offices at 432-4 Commercial National Bank building, Houston, Tex., and has added a department of surveys for the general development of land for the market.

Charles A. Finley, who for seven years has been superintendent of the Bureau of Engineering and Surveys, Pittsburg, has been appointed successor to A. B. Shepherd, who recently resigned as superintendent of the Water Bureau.

E. A. Kingsley, superintendent of public works in Little Rock, Ark., against whom charges had been preferred by one of the aldermen, scored a complete victory at the council meeting held March 3, which thoroughly vindicated him after a detailed investigation of the charges by a committee which had held several hearings.

MACHINERY AND TRADE

A Portable Atlas Dryer.

The accompanying cut shows an Atlas dryer portably mounted for transportation over street roadways, the latest achievement of the Atlas Dryer Co., of Cleveland, O., in meeting the coming demand for a dryer or heater which will be available for rural districts and country roads where railroad asphalt plants can not be located close enough to the work to warrant their use. The dryer shown is one of a number of sizes and can be furnished in conjunction with melting tanks, mixer platform and other requirements for an asphalt paving plant, each unit being portably mounted for transportation.

Concrete Spreading Dump Cart.

The Goit Manufacturing Co., Oklahoma City, Okla., has put on the market a standard track dumping cart of 21 cubic feet capacity, which has the smallest possible amount of machinery.

The mechanical design causes the quadrants that form the dumping body to be actuated by gravity, and to assume a vertical when they revolve into dumping position, and the reciprocal motion thereby imparted to the respective quadrants causes the top to roll or close inward, simultaneous with the opening of the bottom, insuring free and unobstructed delivery of the load. The form of the body and the operation are similar to the clam-shell bucket; but each of the quadrants has its own individual pivot points upon which it revolves when released by the dumping lever, causing them to open and dump their load by gravity.

The spread of the quadrants when in dumping position is 21 inches, which is exactly one-half of the measurement of the full spread of the top sides of the body when loaded, consequently the quadrant forming the dumping body must be vertical when dumping. However, the opening may be regulated by the dumping lever so as to discharge the load gradually at the option of the operator.

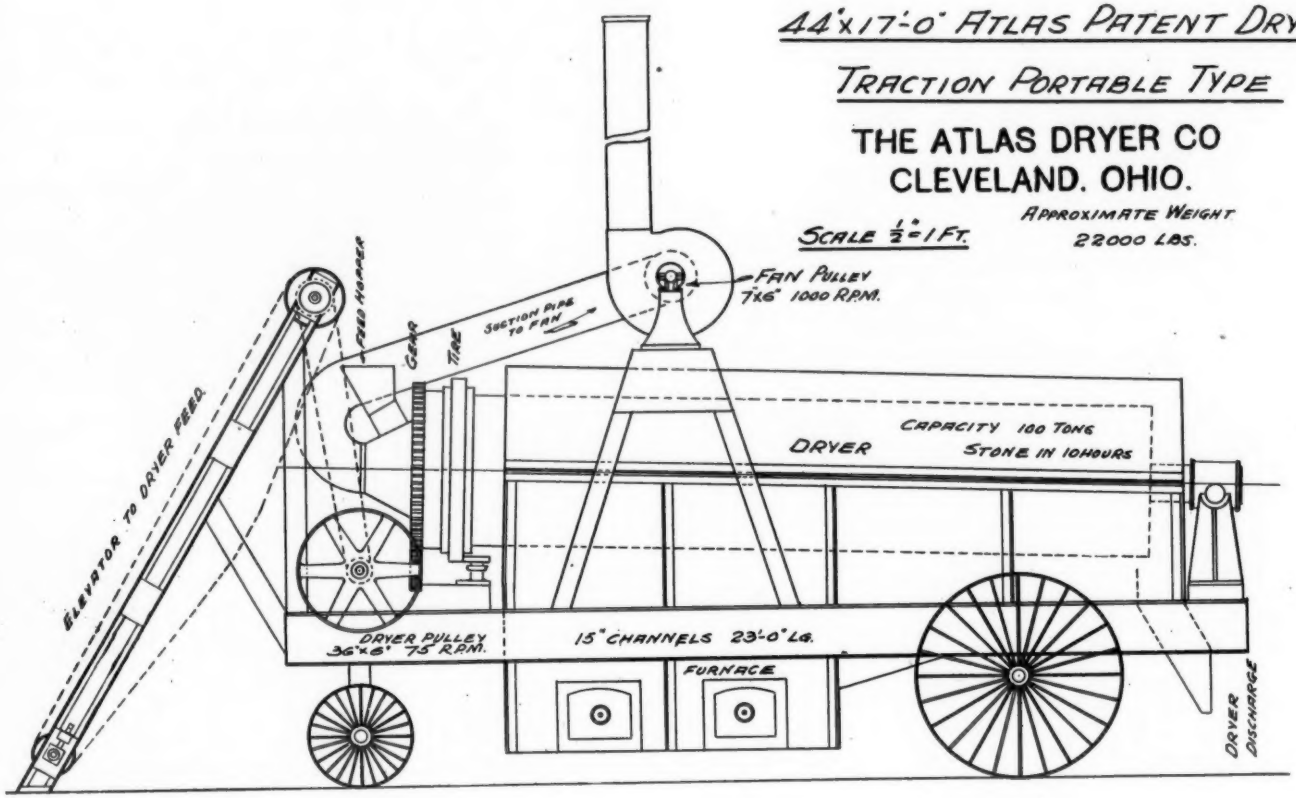
44'x17'-0" Atlas Patent Dryer

Traction Portable Type

THE ATLAS DRYER CO
CLEVELAND. OHIO.

Scale 1/2"=1 Ft.

Approximate Weight
22000 Lbs.



The body is of No. 10 steel plates with angle iron reinforcing frame and ends reinforced with ¼ by 3-inch bars, all securely riveted and forming a practically water-tight joint between the two quadrants when closed. The panel plates securing the quadrants in position are bracketed to the axle and braced to the frame. Rollers eliminate friction on pivots and bolts supporting the body.

The frame on which the body is mounted is 5-inch channel iron, secured to the axle by four clips and with heavy angle iron reinforcement at corners.

The single axle extends across and through the panel plates 18 inches above the closure of the body quadrants, so that it does not interfere with the free exit of the load.

Wheels are ample and shafts of gas pipe are secured by clips and bolts to the channel iron frame so that the cart can be readily knocked down for transportation. The company will supply all desired information on request. Contractors and engineers will be specially interested in the economy, durability and strength of this cart.

The Baker Armored Concrete Pavement.

Concrete pavements were laid as long ago as 1890 or 1891, and the first pavements are still in use and in good condition except some wear at the joints. The same complaint of wear at the joints is made concerning numerous other concrete pavements, and to obviate this difficulty the Baker armored concrete pavement was devised.

The R. D. Baker Co., of Detroit, Mich., have prepared specifications for the pavement, which conform to the best practice and if followed by men capable of doing good concrete work, will give a good durable pavement. Excavation to sub-grade and rolling with 7-ton roller is provided; then a foundation, 5 inches thick, of concrete, 1 part cement to 3 parts sand and 6 parts broken stone or pebbles, all absolutely clear of any clay, loam or other foreign matter, and the stone graded from ½ to 2-inch sizes and voids just filled with the sand; then a 2-inch wearing surface of 1 part cement, 1½ parts clean, sharp sand and 3 parts hard-head pebbles not less than ¼ and not more than ½ inch in diameter, the proportion of sand being varied so as to completely fill voids and make a water-tight concrete in both foundation and wearing surface.

Then expansion joints ½ inch wide are provided for, extending from curb to curb every 25 feet and wherever necessary to provide for expansion and contraction. When the concrete is being placed, a dividing board will be put in place to fill the opening for the joint. This board will be shaped to the crown of the street. To it will be clamped angles or ¼-inch steel plates, 3 inches wide, also shaped to conform to the crown of the street. These plates are provided with "shear members," which tie them securely to the concrete base and wearing surface. After the pavement is finished the dividing board is removed and the opening is covered with tar paper until it can be filled with No. 6 paving pitch or other specific filler. Mr. Baker provides for securing a uniform surface with an iron-shod "strike," rigid and unyielding and shaped to conform to the crown of the finished pavement, which is so used as to leave the surface a trifle rough and gritty, thereby affording a good foothold for horses.

The plate armor for the edges of the blocks prevents the blow of wheels against the thin edge of concrete, and thus the breaking of this edge, the consequent increase in width of joint, the heavier blows on the concrete and the further disintegration are prevented.

Concrete pavements have usually been restricted to the more lightly traveled streets, but with Mr. Baker's steel plate armor it would seem that they could be used on streets of the heaviest traffic, since the wear on joints is the most serious complaint against concrete pavements as well laid as Mr. Baker's specifications provide and with the rough surface which he prescribes.

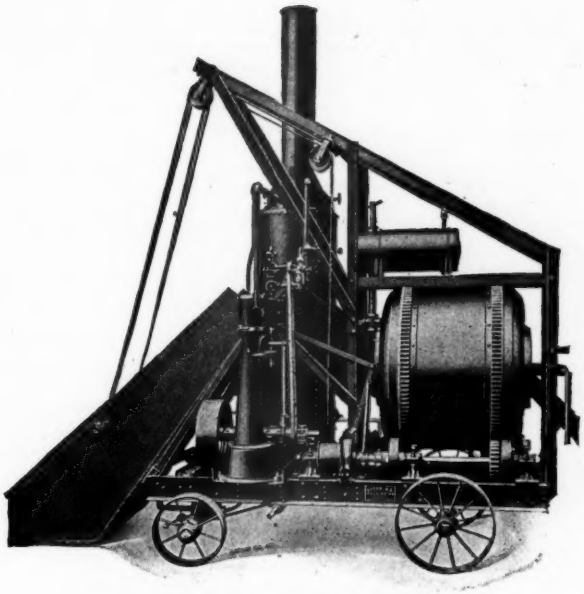
REINFORCING JOINT PLATE FOR BAKER'S REINFORCED CONCRETE PAVEMENT.

The accompanying cut shows the armor plate with the projecting "shear members" which have been partly cut out of the plate and bent back so as to project into the concrete and be held by it.

A Successful Concrete Mixer.

There are so many concrete mixer patents granted these days that one who does not know the records of performance of the machines may easily go astray. The Koehring mixer is one which has demonstrated its adherence to the four cardinal points in a mixer, durability, simplicity, reliability and economy. A recent catalog shows many photographs of Koehring mixers on the work, and photographs of car loads of them on the way to Seattle and Los Angeles, showing that their good qualities are known very widely.

The first of the accompanying cuts



1. KOEHRING CONCRETE MIXER.
No. 1-B on Trucks With Elevating Charging Bucket and Water Measuring Tank.

2. KOEHRING CONCRETE MIXER.
No. O Street Paving Mixer With Steam Engine, Boiler, Elevating Charging Bucket and Water Measuring Tank.

shows mixer 1-B on trucks, equipped with elevating charging bucket and water measuring tank. This mixer has a capacity of 11 cubic feet of the materials, which are shoveled into the charging bucket, which is then tipped up by means of a hoisting drum. The batch, when mixed, is discharged on the opposite side by throwing the discharge chute into position. Discharge is stopped instantly by throwing the chute out of that position. The machine will turn out 14 cubic yards of mixed loose material per hour at a drum speed of 17 revolutions a minute, using a 6-horsepower steam engine or a 7-horsepower gasoline engine.

The second cut shows the No. 0 street paving mixer with steam engine, boiler, elevating charging bucket and water measuring tank. This mixer has a capacity per batch of 9 cubic feet per hour of 14 cubic yards of loose materials, or 75 square yards of street, and will keep 17 men busy supplying material and placing it in the street, including engineer and foreman. An attachment of boom and traveling bucket can be put on, which will deliver the material at any desired point of the street width within the reach of the boom.

The Koehring Machine Co., Milwaukee, Wis., will send on request a catalog showing the various styles and sizes of mixers and the attachments. The catalog describes in full the methods of construction of the machine and the reasons for its economy and durability. It also shows the various attachments, such as water measuring tank, a concrete hoist to be run by the same engine as the mixer, the hoisting drums and stone crusher, crushed stone elevator, and screen, an excavating loader, and wheelbarrows of their manufacture. Full instructions are also given for setting up and running the machinery.

Sandstone Curbing.

The best proof of the durability of curb is the reference to the streets on which it has been used and for this reason the accompanying photographs are shown. The first shows Magnolia Drive, Wade Park, Cleveland, O., with Berea sandstone curbing which has been in use for 30 years. The second shows a Berea sandstone curb which has been in use on N. Prairie st., Bloomington, Ill., for 18 years or more. The writer has seen both of

1. BEREA SANDSTONE CURBING IN CLEVELAND, O.
In Use 30 Years, Magnolia Drive, Wade Park.

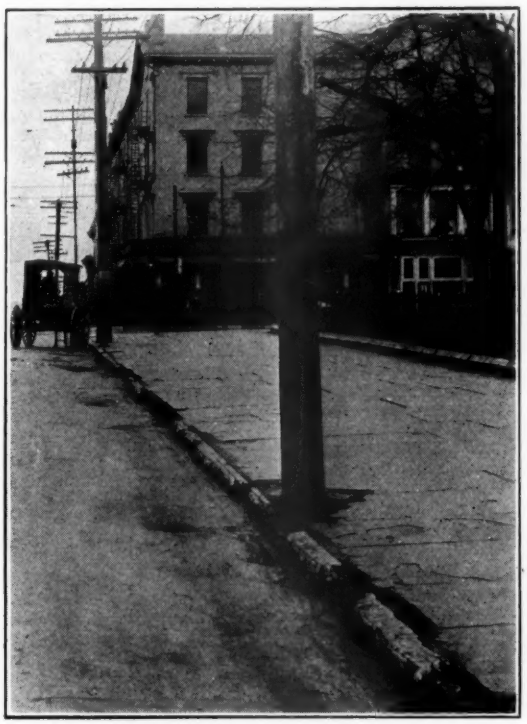
these streets and the curbs show the same perfection of outline that is indicated by the small size photographs. He has also seen the limestone curb on E. State st., Columbus, O., shown in the third photograph, in use some 12 or 15 years, and knows that its condition is not exaggerated by the camera. These are quite convincing evidences of the durability of sandstone curb and of the lack of durability of some kinds of limestone curb.

The Berea sandstone from the quarries of the Cleveland Stone Co., at Berea, O., contains 96.90 per cent. of silica and has a crushing strength of 10,000 pounds per square inch. The quarry is fully equipped with machinery for cutting curb in any desired style. The standard style is machine dressed with "bull nose" or rounded corner. The top and face are

tooth-chiseled by the machine before shipping. The back and ends are left rough and are dressed after the stone is delivered on the ground. The dressed curb is also furnished with a straight edge if desired, though most shipments have the bull-nose. There are also many shipments of undressed curb.

The quarries are practically inexhaustible and hundreds of miles of curbing are shipped each year. Full information will be supplied by the Cleveland Stone Co., Cleveland, O.

2. SANDSTONE CURB IN BLOOMINGTON, ILL.
In Use 18 Years on N. Prairie St.



LIMESTONE CURB IN COLUMBUS, O.
Almost Disintegrated on E. State St. After 12 to 15 Years Use.

An Automatic Letterer.

Ralston J. Markoe, 14 Summit avenue, St. Paul, Minn., has copyrighted a device for saving time in drawing letters on building plans, maps and other drawings,

leaving the tracing only of the letters to be done. It contains 32 standard alphabets of different sizes, with the corresponding numerals, besides many words and phrases in common use upon drawings. Extra large letters and numerals are available for drawings that are to be reduced photographically.

The operation of the device is very simple and it will be found very convenient for making up titles on the tracing cloth copies of drawings. Mr. Markoe will send it by mail postpaid for $1.

Aquabar for Waterproofing.

Aquabar is a water-proofing material which is mixed with the water used for mixing concrete. It crystallizes in chemical combination with the cement and forms a part of the concrete mass and makes it waterproof. It has long been used in Germany and by the U. S. government, and is specified by many prominent architects.

The Girvan-Nachod Co., general sales agents for the Aquabar Co., 1228 Locust St., Philadelphia, will send full information on request.

Briggs Concrete Spreader and Dump Carts.

The Briggs Labor Saving Specialty Co., Waterloo, Iowa, have had on the market for about 5 years a concrete spreader cart which has had great success on account of its attractive features. It is a 2-wheeled cart of No. 10 and 12 steel plate reinforced with steel angles. Leaves in the bottom open by gravity on being tripped from the cart handle, letting the concrete drop in a manner to spread it thoroughly. The cart is so well made that the makers guarantee that contractors spend less money on repairs for them than on any other class of equipment on their work.

They also make a water-tight steel tip-over dump cart, the bed or hopper being hung on a round steel axle with enough excess weight above the axle when loaded to dump the load when the lock is released. This cart holds 12 or 15 wheelbarrow loads and can be used with any batch or continuous concrete mixer. It Ft. Worth, Tex., four carts hauling 300 feet keep a ¾-yard batch mixer going, and on 100 foot haul two carts keep it busy. The combination has put in 168 cubic yards of concrete street foundation in a day.

The company also sells harness for the cart horses. Send to them for full information.

McGraw Electrical Directory.

The McGraw Electrical Directory, published semi-annually in April and October at $10 a year covers the lighting and power field thoroughly. It gives a list of central electric stations in the United States, Canada and Mexico, with names of officers and abstract of equipment and business, with a summary and index; a classified directory of manufacturers of apparatus for such stations; a list of electrical supply dealers and contractors; a dictionary for buyers, consisting of concise descriptions of electrical apparatus and equipment furnished by advertisers in the book; a list of electrical fittings approved by the National Board of Fire Underwriters; reference tables. and the officers of the electric light associations of the country. The lists are guaranteed by an offer of $1 to subscribers and advertisers for every six envelopes returned by the post office undelivered.

The book is indispensable to those in its field.

A Cement Booklet.

A 36-page copyrighted booklet has just been published by the Superior Portland Cement Co., whose offices and sales department are in the Union Trust Building, Cincinnati, O. The spokesman is Mr. J. B. John, general manager, who built the model Superior mill at Superior, Lawrence county, Ohio. The reader takes a little journey with Mr. John from the quarries to the market, each step in the process of Portland cement manufacture being explained on the way. This lucid booklet is well typed, illustrated and printed, and will certainly be perused with interest alike by engineers, contractors, dealers and users of Portland cement. As the Superior raw material runs very low in magnesia, there is a printed chapter on this subject, as also numerous birdseye views of "Superior monuments," showing many important works where Superior cement has been used. Booklet C 9 will be mailed on request.

Corrugated Metal Culverts.

The receipt of two new booklets from the Canton Culvert Co., Canton, O., calls for some notice of their handsome appearance and the excellent manner in which the information they contain is presented.

The Acme nestable corrugated metal culverts are worthy of the attention given them, and the illustration in the pamphlets show the work which they are required to do and which they are able to sustain.

One of the booklets is devoted to steam and electric railways and shows culverts 15 to 60 inches in diameter, of 12 to 16-gauge metal under fills of 3 to 33 feet depth.

The other pamphlet shows the adaptability of the Acme culvert to highway work and shows culverts up to 72 inches in diameter.

This culvert has a number of advantages some of which may be recapitulated. The metal is practically pure iron and loses 2.7 per cent. on immersion in a 20 per cent. solution of sulphuric acid at atmosphere temperature as compared with

a loss of 83.2 per cent. by steel under the same conditions. The corrugated semicircular sections break joint top and bottom so as to make the culvert all of the same strength. The top and bottom sections are fastened together so as to retain their relative positions and they overlap the adjoining sections longitudinally so that they are equally well joined both ways. The sections are nested together for shipment so that the plates for a culvert 40 feet long can be carried by one man.

The culverts are fully guaranteed for 25 years.

The booklets should be sent for on account of the valuable information they contain concerning culvert construction, as well as the instruction about the uses and varieties of the Acme and Imperial No-Co-Ro metal culverts themselves.

A Spanish folder tells the tale in that language also.

Cost of Sewer Cleaning in New York City.

The following table shows the mileage of sewers in the borough of Manhattan, New York City, for each year since 1886, the number of miles of sewers cleaned each year, and the cost of cleaning these sewers per mile.

Year.	Miles of Sewers.	Miles Cleaned.	Cost per Mile.
1886	414.20	10.6	$2,050
1887	421.51	15.2	1,210
1888	429.09	19.3	1,370
1889	433.73	30.5	1,000
1890	437.89	45.6	810
1891	444.29	25.2	690
1892	449.37	14.7	760
1893	455.80	17.6	750
1894	461.52	14.9	640
1895	468.20	12.0	630
1896	472.18	36.5	780
1897	483.06	47.6	710
1898	484.35	43.8	640
1899	489.05	44.4	1,520
1900	494.57	56.6	980
1901	496.94	66.2	980
1902	500.59	85.6	690
1903	505.08	124.5	470
1904	507.64	132.6	470
1905	511.36	99.7	660
1906	513.77	144.8	510
1907	517.97	205.6	490
1908	521.67	218.7	440
1909	523.34	248.8	360

Placing Concrete in Freezing Weather.

There is a doubt in the minds of a number of well known chemists as to the action of salt on concrete. Whether it is injurious or not, there is always some likelihood of efflorescence resulting after the concrete has thawed and warmer weather sets in. Therefore, I would suggest the following method of placing concrete in freezing weather, the thermometer not to be below plus 20 degrees F.

If a machine mixer is used, mix and place immediately one batch at a time. If hand mixing is used, do not mix over a two bag batch and place immediately. Heat the sand and stone by piling over a sheet metal arch or a large cast iron pipe, building the fire under the arch or in the pipe, the pipe to be tilted so as to form a draught. Heat the water as hot as possible in a kettle, or use water from a steam boiler.

The action of hardening is thus stimulated and the concrete will not cool before it has set hard. If the weather continues below freezing leave the forms in, place until the temperature is above plus 40 degrees F., the action of crystallization will then continue.

(From instructions by Albert Moyer, sales agent Vulcanite Portland Cement Co., New York City.)

Trade Publications.

The latest Lehigh Portland Cement Co. publications are mainly given up to reinforced concrete bridge construction, with many pictures of buildings and other structures using large quantities of Lehigh cement, and the water filtration plants at Louisville and Ashtabula, O.

The Ansonia Mfg. Co. issues a pamphlet describing and illustrating their apparatus for controlling the flow of sewage from septic tanks.

The Business Men's League of St. Louis issues a booklet on St. Louis in 1910 which is crowded full of facts about the fourth city in the United States.

Bulletin No. 70 of the Universal Portland Cement Co. is devoted to concrete in mine construction, a new reinforced concrete building of the Studebaker Bros. Mfg. Co. in Chicago and concrete in the city beautiful.

The March bulletin of the Edison Portland Cement Co. is filled with pictures of reinforced concrete buildings, in which Edison cement has been used.

The Reinforced Concrete Co. of St. Louis, Mo., formerly the Reinforced Concrete Construction Co., announce the reconstruction of their business to the engineering features of reinforced concrete construction in a booklet which is unique in form and a very convenent compound of pictures of work done by the company, statements of buildings designed and constructed by them, standard specifications for reinforced concrete buildings and drawings of designs for details and a large arch bridge.

The American Telephone & Telegraph Co. has issued its annual report for 1909 to stockholders.

J. W. Howard, consulting engineer on roads, streets and pavements, 1 Broadway, New York, sends a letter setting forth the facilities of his office for designing pavements, inspecting and testing materials and construction.

The Dunn Wire Cut Lug Brick Co., Conneaut, O., issue a circular describing Dunn's reciprocating automatic cutter for cutting paving blocks and face building brick, with or without round edges, grooves in ends, manufacturer's brand on one end or any configuration desired to be stamped on the face of the brick, thus

showing the adaptability of the apparatus to required conditions.

A handsome special publication of the Universal Portland Cement Co., on which a price of 50 cents is set, is entitled "Representative Cement Houses" and shows many handsome photographs of residences and of outside finishes for cement work.

The Patten Mfg. Co. make Patten double platform hoists with winches and motors, which are shown in Bulletin 101.

The Clinton Wire Cloth Co. has begun the publication of a series of descriptions of work done with their materials under the title "Steel Fabric."

The Ruggles-Coles Engineering Co., Chicago and New York, have issued a new catalogue of their dryers which gives full illustrated descriptions of construction, operation, capacity, dimensions, economy and results of tests of their Class A dryer, and shorter descriptions showing the variations in dryers of Classes B, C, D, E, F and of special dryers, the various materials requiring modifications of construction and operation to fit the conditions. The booklet also has many reproductions of commendatory letters from cement, plaster, sand, stone, asphalt and other companies and a list of the many purchasers of the Ruggles-Coles dryers.

Troy dump wagons and dump boxes are well described in two handsome circulars issued by the Troy Wagon Works Co., Troy, O., which show the reasons for the great popularity of these efficient "wagons of performance."

Wahsatch structural paint for bridge and structural steel and iron work is described in a large circular and shown to be a "low-priced paint with a high-price record," issued by the American Asphaltum and Rubber Co., Chicago, Ill.

Jefferey rubber belt conveyors are described and price listed in Booklet No. 35 of the Jeffrey Mfg. Co., Columbus, O.

The March "Pipe Parley" shows several large cast-iron pipe T's which have recently been completed at the Radford, Va., works of the McWane Pipe Works for the Panama canal.

The "Farm Cement News," issued monthly by the Universal Portland Cement Co., gives detailed instructions for doing concrete work on the farm.

The Chain Belt Co. issue a catalogue of chain belt concrete mixer.

Trade Notes.

ASPHALT.

Emeryville, Cal.—Special.—R. L. Hawley, cy. engr., is in the market for an asphalt repair plant.

Kansas City, Kan.—The Rackliffe-Gibson Co. will begin at once the erection of a paving plant for the construction of Hassam pavement.

CEMENT.

Philadelphia, Pa.—The United States court appointed, March 4, William E. Erdell of Allentown, Pa., receiver for the Penn Allen Portland Cement Co., whose plant is situated at Nazareth, near Allentown.

Omaha, Neb.—The Nebraska Portland Cement Co., with general offices in the Omaha National Bank Bldg., will begin the work of construction on its plant, to be located at Superior, Neb., within two months. The officers of the company are: President, C. McLaughlin; treasurer, C. E. Adams; secretary, H. G. Calkins.

Nazareth, Pa.—The Crichfield Portland Cement Corporation, with headquarters here, will begin the construction of a plant near Knoxville, Tenn., this spring. S. Henry Harrison is engineer for the company.

Atlanta, Ga.—The Georgia Portland Cement Co. contemplates building a plant this spring.

The Pittsburg Architectural Club has distributed the $500 in prizes for designs of a suburban concrete residence and garage, offered by the Universal Portland Cement Co., five of the eight prizes and honorable mentions going to competitors in Pittsburg and vicinity, two to Brooklyn and one to Boston.

Wm. E. Dee Co. move on May 1 to 1026-30 Chicago Stock Exchange Bldg., 108 LaSalle st., Chicago, Ill.

CONCRETE BLOCKS.

Tucson, Ariz.—The Gates Reinforced Concrete Railroad Tie Co. has been incorporated by Frank Ross, T. T. Tourtillott, J. H. Jarman, George Gates and James R. Kidward.

Grand Junction, Col.—The Modern Construction Co. has been incorporated to manufacture concrete and clay products and to conduct general construction business. The officers of the company are: President, G. H. Wiltse; secretary and treasurer, O. B. Lopstedt.

PURCHASE OF MACHINERY.

Emeryville, Cal.—Special.—R. L. Hawley, cy. engr., is in the market for an asphalt repair plant.

Honolulu, Hawaii.—Special.—John H. Wilson, road supvr., advises us that he is in the market for road machinery.

Eau Claire, Wis.—The Gisnau Mfg. Co. has been incorporated to manufacture cement weighing and other machinery, by Peter Gisnau, E. F. Bolte and H. J. Schneider.

Paris, France. — Special. — Arthur H. Blanchard, care American Express Co., 11 Rue Scribe, desires catalogs of asphalt macadam mixing machinery and bituminous material distributors.

Litchfield, Ill.—Special.—David Davis, chmn. com. on industries, says the citizens, headed by the Merchants' Association, are endeavoring to induce the city council to establish some regular system of cleaning the brick-paved streets, which may result in the purchase of some street-sweeping machinery and sanitary carts or dump wagons before the season is over.

North Adams, Mass.—(Special). Clifford C. Haskins, 41 Highland ave., is in the market for a transit.

Henry, Tenn.—(Special). J. H. Hoskins, C. E., care Good Roads Contracting Co., advises us that he is interested in the question of purchasing road and street paving machinery.

Orange, N. J.—(Special). John Harms, 50 Casey st., advices us that he desires to purchase a small concrete mixer, with gasoline power, plow for grading, and a horse scraper.

PURCHASE OF MATERIALS.

Paris, France. — Special. — Arthur H. Blanchard, care American Express Co.,

11 Rue Scribe, desires to purchase bituminous materials.

Kalispell, Mont. — Special. — Northern Idaho & Montana Power Co. is in the market for pig lead, calking tools, etc.

Ashtabula, O.—Special.—Charles Huckari, 52 Cherry st., Ashtabula Harbor, desires price list on sewer pipe.

Port Huron, Mich.—Special.—E. R. Whitmore, cy. engr., desires names of firms handling rock asphalt.

Aurora, Ill.—(Special). J. E. Salfisberg & Co., desires to communicate with firms manufacturing special rail brick.

Henry, Tenn.—(Special). J. H. Hoskins, C. E., care Good Roads Contracting Co., is in the market for macadam builders.

MISCELLANEOUS.

Albert Lea, Minn.—The American Culvert Co. has been organized by E. Pankhurst, A. G. Bisbee, E. H. Loomis and Bert Bisbee, of Lyle, Minn., and T. V. Knatvold and C. L. Sirenson of this city.

Aberdeen, Wash.—The Aberdeen Glazed Cement Pipe Co. has been incorporated by Chas. F. Allen, J. C. Smith and J. A. Pinkney.

The H. Cole Co., drafting and engineering supplies, have removed to 43-5 E. Long St., Columbus, .

The Barron & Cole Co. of New York City, owing to the increased demand in second-hand contractors' equipment are opening up a special department to handle this particular line, and have put Mr. George E. Ray in charge as manager, formerly of the Russell Contracting Co., also of New York.

Stone & Webster Engineering Corporation in addition to strictly engineering work have over $11,000,000 of construction contracts under way, waterpowers, interurban railways and buildings in the western states constituting a large majority of their work.

The Robins Conveying Belt Co. have moved their executive, sales, engineering and purchasing departments to the Park Row Building, New York.

At the annual meeting of the board of directors of the Keller Manufacturing Co., Philadelphia, the following officers were elected: Julius Keller, president; W. P. Pressinger, Wm. H. Keller, S. W. Prince, vice-presidents; Francis J. Rue, treasurer; C. S. Bell, secretary. The Keller Manufacturing Co. of Philadelphia has purchased the business of the W. P. Pressinger Co. of New York, its general eastern distributer and distributer for Michigan, and this territory will hereafter be handled direct by the Keller Manufacturing Co. Mr. J. J. Swan, secretary of the W. P. Pressinger Co., will be associated with the Keller Manufacturing Co. Mr. Charles Strader has been placed in charge of western agencies with offices at Chicago and Lincoln, Nebraska.

Patents Concerning Cement Blocks, Bricks and Artificial Stone (Continued).

903,734. Divided Bond for Two-Membered Concrete Building Blocks. Ludwig B. Larsen, Portland, Ore.

903,906, 903,907, 903,908. Interlocking Brick, Building Brick or Block and Machine for Making. Joseph Soss, New York, N. Y.

903,916. Machine for Making Concrete Slab. Ora D. Tegarden, Columbus, Tenn.

904,513. Machine for Molding Concrete Building Blocks. Chas W. DeArmon and John L. McKinney, Piqua, O.

904,588. Building Block and Wall Constructed Thereof. Wm. T. Wightman, Half Moon Bay, Cal.

904,927. Mold for Building Blocks. Wm. A. Boeck, South Omaha, Neb.

907,299. Machine for Making Cement Building Blocks. Alfred Stroeh, Hooper, Neb.

907,699. Building Block. Wm. D. Moore, Creston, Iowa.

908,018. Cement Block Machine. Paul A. Lawin, Long Prairie, Minn.

909,792. Facing Artificial Stone. John C. Henderson, Oakland, Cal.

910,571. Reinforced Molded Building Block. Geo. A. Peterson, Oakland, Cal.

911,110. Mold for Building Blocks. Wm. N. Box, Northfield, and Haughton Brown, Minneapolis, Minn.

911,547. Process for Hardening Calcareous Artificial Stone Substances by Means of Carbonic Acid. Erich Schwaneberg and Albert Rinne, Hanover, Germany.

912,057. Concrete Shingle. Emery P. Anger, Corinth, Miss.

912,080. Cement Building Block. John Crawford, Millinocket, Me.

912,367. Mold for Artificial Stone or Concrete Posts. Orville Dougherty, Jas. W. and Adam E. Armstrong, Three Rivers, Mich.

913,116. Mold for Molding Concrete Blocks. Anton Evenstad, Lakota, N. D.

914,367. Concrete Block Machine. Emery P. Auger, Corinth, Miss.

914,507. Concrete Block. Herbert N. Pettigrew, New Orleans, La.

915,283. Mold (for Gutter Tiles). Wm. E. Frost, Highland Mills, N. Y.

915,287. Mold for Concrete Sign Posts. Leo G. Haase, Pasadena, Cal.

915,517. Machine for Making Concrete Blocks. Peter Wecht and John Winfield, Fostoria, O.

915,556. Cement Block Machine. Oscar Coon, Chicago, Ill.

915,982. Gage for the Spacing Apart of Concrete Building Block. Clawson M. Maddox, Muncie, Ind.

916,260. Molding Concrete Blocks. Henry Briggs, Hasbrouck Heights, N. J.

916,409. Artificial Stone. Chas. A. Begle, Ann Arbor, Mich.

916,687. Cement Building Block. Chas. W. Everett and Earl Ashcraft, Dresden, O.

916,689. Concrete Block Mold. Wm. H. Faulkner, Delta, Colo.

917,004. Manufacture of Blocks, Plates and Other Articles for Use in Road Making, Building, and for Similar Purposes. Harold M. Clifford, Westminster, Eng.

917,141, 917,142. Apparatus for Molding Concrete. Jos. F. Ross, Ipswich, Mass.

12,935 (Reissue). Centrifugal Block Machine. Menzo Nashold, Davis Junc., Ill.

917,930. Building Block. F. A. W. Davis, Indianapolis, Ind.

919,891. Mold for Forming Artificial Stone Blocks. Edward M. Lane, Haddon Heights, N. J.

920,212. Building Block and Wall Constructed Thereof. Sutton Strong, Terre Haute, Ind.

920,851. Concrete Block Machine. Lewis Flanagan, Denver, Colo.

921,287. Machine for Stamping Concrete Blocks and the Like. Hugo Schmidt, Charlottenburg, Germany.

921,659. Machine for Making Concrete Blocks for Buildings. Wm. G. Bailey, Dublin, Ireland.

922,594. Building Block. Roy E. Keagle, Lodi, Cal.

922,997. Concrete Mold. Wm. H. Alexander, Long Branch, N. J.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

New Orleans, La.—This city brought suit in the civil district court, March 5, against the Sicilian Asphalt Paving & Construction Co. and the American Bonding Co., of Baltimore, for $14,898.97, which the city claims is due it by reason of the defendant paving company having paved certain streets which had later to be repaved by the city at an expense amounting to the sum sued for. The bonding company is sued because it is alleged to be the surety in the paving company's contract.

CONTEMPLATED WORK.

Dayton, Wash.—Paving is contemplated for Main st.

Dallas, Tex.—Paving is contemplated for Commerce st.

Watkins, N. Y.—Paving is contemplated for Franklin st.

Owatonna, Minn.—The question of paving is being urged.

Kokomo, Ind.—Paving is contemplated. J. H. Watson, cy. engr.

San Diego, Cal.—Paving is contemplated for 4th, 1st and E sts.

Bakersfield, Cal.—Paving is proposed for K, 23d, 24th and 25th sts.

Bartlesville, Okla.—This city contemplates paving 96 blocks of streets.

Youngstown, O.—Paving is contemplated for Breaden and Broadway sts.

North Yakima, Wash.—Bids will be opened about April 5 for 29 blocks of paving.

Pasadena, Cal.—The city council has decided to pave Holliston ave.

Atlanta, Ga.—Paving is contemplated for Spring st. at a cost of $20,000.

Moline, Ill.—A resolution has been passed for paving 55th st. and 4th ave.

Chariton, Ia.—A resolution has been passed to pave Auburn ave. and Grund st.

St. Joseph, Mo.—Ordinances have been passed for paving 33rd st. and Kansas ave.

Normal, Ill.—An ordinance has been passed to pave Main st. with Posten vitrified block.

Hammond, Ind.—Plans have been completed for paving Highland st. Otto H. Duelke, cy. clk.

Georgetown, Wash.—An ordinance has been passed for paving Rainer ave. with vitrified blocks.

Algona, Ia.—This city contemplates paving 10 blocks with brick. S. W. Crowell, cy. clk.

Wilkesbarre, Pa.—Brick or asphalt paving is contemplated for Barnum Place and Wyoming st.

Atlantic, Ia.—A petition has been submitted to council asking that W. 6th st. be paved.

Greenwood, Ind.—About 8 blocks of brick paving is contemplated. L. E. Pritchard, pres. town bd.

Albert Lea, Minn.—Paving is contemplated for Main st., but the material has not yet been selected.

Sandusky, O.—A resolution has been passed to pave 6 blocks of Washington st. with asphalt or brick.

Marshalltown, Ia.—Council voted to construct about 4000 sq. yds. of brick paving and 3000 ft. of curbing.

Norfolk, Va.—Paving is contemplated for Omohundro and Moran aves., 10th, 4th and other streets.

Hackensack, N. J.—The board of chosen freeholders has decided to construct about 15 miles of roads.

Evanston, Ill.—An ordinance has been passed for paving Dartmouth Place with macadam. J. H. Mowe, comr. pub. wks.

Louisiana, Mo.—About 7 blocks of vitrified brick paving is contemplated. H. J. Findlay, cy. clk.

Alvin, Tex.—This county may vote on the question of issuing $250,000 bonds for constructing good roads.

Toledo, O.—This city contemplates the construction of 9 blocks of concrete paving. J. M. Idchty, cy. clk.

Greenfield, Ia.—Plans are being prepared for constructing 1 mile of vitrified brick paving. Geo. B. Musmaker, mayor.

Pasadena, Cal.—Vitrified brick paving and cement walks are contemplated for S. Broadway. Hieman Dyer, cy. clk.

Mt. Pleasant, Ia.—A contract will be let soon for constructing 35 blocks of brick paving. C. E. Waterhouse, cy. engr.

Floodwood, Minn.—The construction of new sidewalks and grading and improving the streets is contemplated. John Stokke, pres. vil. coun.

Akron, O.—Ordinances have been passed providing for the improvement of Wabash, Dock, Paige, Moeller, Edgewood, Berry and Glenwood aves.

Mt. Vernon, Ill.—Plans have been completed and bids will be asked about May 1 for vitrified brick paving. L. C. Morgan, mayor.

Billings, Mont.—This city is considering plans for constructing $200,000 worth of vitrified brick and creosoted wood block paving.

Atlanta, Ga.—A macadamized boulevard from Ponce de Leon ave. in the Druid Hill section to the courthouse in Decatur, is contemplated.

Goshen, Ind.—The property owners in S. Main st., from Douglas st. to College ave., have petitioned for vitrified brick paving. S. F. Spohn, mayor.

Washington, N. C.—This city has decided to expend $30,000 for paving the streets with macadam and constructing concrete sidewalks. D. B. Packard, cy. engr.

Jackson, Miss.—An ordinance has been passed providing for about 45,000 sq. yds. of paving. The material has not yet been decided upon. B. H. Klyce, cy. engr.

Asheville, N. C.—The city engineer has been directed to prepare specifications for paving Jefferson drive, Clayton, Flint, Hillside, Cherry and Chestnut sts. and Montford ave.

Stockton, Cal.—Specifications are being prepared and bids will be asked about April 1 for improving Cherokee, Waterloo, and Linden roads. F. A. Eckstrom, secy. county highway com.

Cedar Lake, Minn.—Resolutions have been passed by the good roads committee of the Commercial Club providing for the

improvement of 6 miles of roads immediately adjoining the city.

Shawnee, Okla.—The chamber of commerce voted to ask the mayor and council to call an election to vote on the question of issuing $200,000 bonds for the purpose of constructing a boulevard.

Leetonia, O.—Special.—Plans and specifications are being prepared and the contract will be let in April for about 3000 lin. ft. of brick paving. R. R. Stockwell, cy. engr.; F. A. Whittacker, cy. clk.

Richmond, Ind.—The trustees will make a report April 9 on the question of improving the National Road from W. 5th st. 3 miles west. L. M. Pierce, Hagerstown, and E. S. Martindale, Greensport, trustees.

Peoria, Ill.—The paving contemplated in this city, involving about 12 miles of Westrumite, is proposed for a system to include Hillyer and Elizabeth sts. and Harris ave. Another boulevard place has been suggested for Perry ave.

Philadelphia, Pa.—According to reports submitted to Mayor Reyburn, March 3, by Chief McLaughlin of the Electrical Bureau and Director Stearns of the Public Works, it will require $4,000,000 to put into effect the proposition to pave all main streets between Vine and South sts., Delaware and Schuylkill rivers, and to illuminate them as Market st. is now lighted east of Juniper st.

CONTRACTS TO BE LET.

Fowler, Ind.—Bids are asked until April 9 for constructing 4 roads. Lemuel Shipman, co. audt.

Muncie, Ind.—Bids are asked until April 8 for improving a highway. Joseph E. Davis, co. audt.

Tipton, Ind.—Bids are asked until April 4 for constructing 2 stone roads. J. F. Barlow, co. audt.

Harrisonburg, La.—Bids are asked until April 4 for improving 25 miles of road in Catahoula Parish, La. Police Jury.

Rockville, Ind.—Bids are asked until April 15 for constructing a gravel road. H. A. Henderson, co. audt.

Delphi, Ind.—Bids are asked until April 4 for constructing 3 gravel roads. M. G. Haun, co. audt.

Decatur, Ind.—Bids are asked until April 4 for constructing 4 macadam roads. H. S. Michaud, co. audt.

Duluth, Minn.—Bids are asked until about April 15 for paving Garfield ave. T. McGilvray, cy. engr.

Williamsport, Ind.—Bids are asked until April 4 for constructing a gravel road in Gill twp. B. C. Crowder, co. audt.

Bozeman, Mont.—Bids are asked until April 7 for constructing cement sidewalks, curbs, etc. Cy. clk.

Eveleth, Minn.—Bids are asked until April 5 for 9700 sq. yds. of paving in Grant ave. D. P. McIntyre, cy. clk.

Monticello, Ind.—Bids are asked until April 5 for constructing a gravel road in Liberty twp. A. G. Fisher, co. audt.

Clarinda, Ia.—Bids are asked until April 12 for constructing 20,500 sq. yds. of concrete paving. C. W. Stuart, cy. clk.

New Castle, Ky.—Bids are asked until April 12 for constructing about 41 miles of turnpike roads. S. Bruce, Judge Henry Co.

Madison, Ind.—Bids are asked until April 7 for constructing a road in Monroe twp. Gaylord F. Crozier, co. audt.

Minneapolis, Minn.—Bids are asked until April for repairing roads Nos. 5 and 8. Hugh R. Scott, co. audt.

Frankfort, Ind.—Bids are asked until April 6 for constructing 6 gravel roads. C. F. Cromwell, co. audt.

Cleveland, O.—Bids are asked until April 6 for improving Woodland road No. 2. A. B. Lea, dir. pub. service.

Fremont, Mich.—Bids are asked until April 4 for constructing 8129 lin. ft. of paving in Main and Stewart sts. Vil. clk.

Rushville, Ind.—Bids are asked until April 4 for constructing a macadam road in Richland twp. Jesse M. Stern, co. audt.

Kokomo, Ind.—Bids are asked until April 15 for constructing a gravel or stone road in Center twp. A. B. Easterling, co. audt.

Carrington, N. D.—Bids are asked until 8 p. m. April 4 for constructing cement sidewalks and crosswalks. M. L. Winterer, cy. audt.

Upper Albion, Ill.—Bids will be asked about May 1 for paving Edwards, Brown, Mills and Averill sts. B. B. Stakemiller, cy. engr.

Corydon, Ia.—Bids are asked until April 4 for one-fourth of the road work for the year 1910. J. A. Wade, twp. clk. of South Fork.

Cando, N. D.—Bids are asked until 8 p. m. April 4 for constructing cement sidewalks and street crossings. H. D. Skinner, cy. audt.

Spokane, Wash.—Bids are asked until April 5 for asphalt and brick paving in Browne's addition, including 22 streets and avenues. B. P. W.

Augusta, Ga.—Bids are asked until April 4 for paving 3500 sq. yds. of North Boulevard with creosoted wooden blocks. R. M. Clayton, cy. engr.

Atlanta, Ga.—Bids are asked until April 4 for paving 35,000 sq. yds. of North Boulevard with creosoted wooden blocks. B. M. Clayton, cy. engr.

Albany, N. Y.—Bids are asked until April 4, 6 and 8 for improving a number of highways. S. Percy Hooker, chmn. State Com. of Highways.

Fargo, N. D.—Bids are asked until April 4 for constructing tile, cement, concrete and tar concrete sidewalks. N. C. Morgan, cy. audt.

Ft. Strong (Boston P. O.), Mass.—Bids are asked until April 4 for constructing roads, walks and drains. Capt. A. H. Miller, constr. Q. M.

Ft. Wayne, Ind.—Bids are asked until April 2 for grading, graveling or macadamizing county highways. John B. Wyss, chmn. bd. co. comrs.

Globe, Ariz.—Bids are asked until April 6 for constructing a highway between Roosevelt and this city. J. J. Riggs, secy. bd. control.

Mt. Carmel, Ill.—Bids are asked until April 4 for constructing 18,000 sq. yds. of brick paving in Cherry st. Guy W. Courter, cy. engr.

Petersburg, Ind.—Bids are asked until April 5 for constructing rock roads. Thos. J. English, chmn. co. comrs; Frank R. Bidderback, co. audt.

Aberdeen, Wash.—Bids are asked until April 6 for paving, constructing concrete walks, curbs and gutters in Market and K sts. P. F. Clark, cy. clk.

Ft. Leavenworth, Kan.—Bids are asked until April 6 for constructing concrete walks, curbs and gutters. Capt. William D. Davis, constr. Q. M.

Mayville, N. D.—Bids are asked until April 4 for constructing various kinds of sidewalks during the ensuing year. W. E. Iglehart, cy. audt.

Aberdeen, Wash.—Bids are asked until April 11 for 25,000 sq. yds. of brick, creosoted wood block and concrete paving. Cy. engr. Washburn.

Grinnell, Ia.—Bids are asked until April 4 for constructing 4000 sq. yds. of vitrified brick paving, and 3000 ft. of curbing in alleys in blocks 3, 4, 7 and 8.

Amsterdam, N. Y.—Bids are asked until April 5 for constructing 4500 sq. yds. of

brick paving in E. Main st. and 3600 sq. yds. in Spring st., April 5. F. E. Crane, cy. engr.

Ft. Dupont (Delaware City P. O.), Del. —Bids are asked until April 4 for constructing 1934 sq. yds. of macadam roads and 3777 sq. ft. of granolithic sidewalks. Constr. Q. M.

Moose Jaw, Sask.—Bids are asked until April 11 for constructing 33,300 sq. yds. of pavement, 13,500 lin. ft. combined curb and gutter, 116,500 sq. ft. concrete sidewalks. W. F. Heal, cy. clk.

Jonesboro, Ark.—Bids are asked until April 5 for constructing 23,000 sq. yds. of vitrified brick block paving, 10,000 lin. ft. curbing and 105,000 sq. ft. concrete walks. B. H. Berger, chmn. bd. impvt. of st. impvt. dist. No. 4.

Platteville, Wis.—Bids are asked until April 14 for constructing 6550 sq. yds. of brick paving in Main and 2nd sts., including 340 lin. ft. curb and gutter, 490 lin. ft. marginal curb, and 320 lin. ft. plain curb. P. D. Hendershott, cy clk.

CONTRACTS AWARDED.

Appleton, Wis.—The contract for paving Union st. with asphalt was awarded to J. F. Hill of Chicago.

Enid, Okla.—The contract for paving work was awarded to the Warner-Quinlan Co., for $107,000.

Orange, Tex.—The contract for constructing 5 ft. sidewalks and curbings was awarded to G. W. Price.

Springfield, Ill.—Henry Nelch & Son secured the contract for repaving Jefferson st., at 42c a sq. yd.

Dallas, Tex.—Special.—The Texas Bitulithic Co. was awarded a contract for 1193 sq. yds. of brick paving.

Flint, Mich.—A contract for paving Garland st. with asphalt block was awarded to the Asphalt Block Co., for $19,768.87.

Rochester, N. Y.—The Julius Friedrich Co. was awarded contracts for paving Laburiuna, Crescent and Alliance ave.

Norfolk, Va.—Special.—The Atlantic Bitulithic Co. was awarded a contract for 2600 sq. yds. of bitulithic paving.

Manitowoc, Wis.—The Schuette Cement Construction Co. was awarded a contract for brick paving for $100,000.

Muncie, Ind.—William Birch was awarded a contract for constructing brick paving in Kilgore ave., for $22,900.

Crawfordsville, Ind.—The contract for constructing 3 miles of the Thomson gravel road was awarded to John Johnson, for $9900.

Lynchburg, Va.—The contract for paving 9th, Commerce and 8th sts. was awarded, Mar. 8, to J. L. Ford & Co., for $33,300.

Los Angeles, Cal.—The contract for paving 43rd st. with asphalt was awarded to George R. Curtis, at 20c a lin. ft.

Charleston, S. C.—Special.—The contract for constructing 7200 sq. yds. of bitulithic paving was awarded to the Atlantic Bitulithic Co.

Norfolk, Va.—The contract for paving Granby st. with creosoted wood blocks was awarded to the U. S. Wood Preserving Co., for $46,715.

Vincennes, Ind.—Contracts for constructing 4 gravel roads were evenly divided, March 8, between Hugh O'Donnell and C. F. Wolfe.

Nashville, Tenn.—The contract for grading and macadamizing Vernon ave. was awarded, March 17, to J. E. Lesueur & Co., for $2985.

Buffalo, N. Y.—Henry P. Burgard was awarded the contract for improving Bailey ave. across the West Shore Railroad, for $78,217.45.

Rochester, N. Y.—The Rochester Vulcanite Pavement Co. was awarded a contract, March 9, for asphalt street paving repairs, for $41,520.

Faribault, Minn.—The contract for 2600 sq. yds. of brick and sandstone paving was awarded, March 18, to Fielding & Shepley, of St. Paul, for $54,000.

Peoria, Ill.—D. A. Myers was awarded a contract for paving N. Glendall ave. with brick in two sections, at $1805.50 and $3760.08 respectively.

Dothan, Ala. — The Graves - Matthew Paving Co., of Birmingham, was awarded a contract for 9 blocks of vitrified brick paving, for $50,000.

Flint, Mich.—J. F. Hill was awarded a contract for paving 3rd st. from Harrison to Avon sts., with Trinidad lake asphalt, for $18,377.88.

York, Pa.—The contract for constructing 2500 sq. yds. of cement paving for the Brillhart estate was awarded to the General Supply & Construction Co.

Pensacola, Fla.—The contract for constructing 535,000 sq. ft. of concrete walks was awarded to W. W. Hatch & Sons, of Goshen, Ind., at 9.49c a sq. ft.

Pittsburg, Pa.—The contract for 5200 sq. yds. of brick paving in Walnut st., Versailles twp., was awarded to Robt. Weir, Jr., of McKeesport, Pa., March 8, for $3000.

Spokane, Wash.—The Western Asphalt Paving Co. has been awarded contracts as follows: Asphalt paving, Broadway ave., $55,000; paving and walks, 3rd ave., $13,377.

Pensacola, Fla.—The contract for constructing 635,000 sq. ft. of concrete sidewalks was awarded, March 10, to W. W. Hatch & Sons Co., of Goshen, Ind., at 11c a sq. ft.

Marshalltown, Ia.—The contract for constructing sidewalks, curbing and paving was awarded to Charles R. Speers. Concrete and tarvia are being considered for paving material.

Lexington, Ky.—The contract for reconstructing the asphalt paving in S. Ashland ave. from Main to High sts., was awarded to Carey & Reed, of Philadelphia, at $2.15 a sq. yd.

Norfolk, Va.—The contract for paving Chapel st. with 3½ miles of creosoted wood blocks was awarded, March 5, to the U. S. Wood Preserving Co., at $2.65 a sq. yd., or $5,167.50.

Lincoln, Ill.—The contract for brick street paving was awarded to A. D. Thompson, of Peoria, March 21, as follows: Kickapoo st., $21,266.18; S. McLean and Clinton sts., $7,229.01.

Carmi, Ill.—The contract for street paving was awarded to A. W. Eisemayer, of Granite City, at $1.64 a sq. yd.; setting 15,330 lin. ft. curbing, 56c a lin. ft.

Waterloo, Ia.—The contract for paving Arigona st. was awarded to the Bryant-Ford-McLaughlin Asphalt Paving Co., as follows: Asphalt, $1.90 a sq. yd.; combined curb and gutter, 60c a lin. ft.

Spokane, Wash.—The Independent Asphalt Paving Co. was awarded a contract for paving 5th ave., as follows: Asphalt paving and sidewalks, $11,800; maintenance of same, $545; paving alley, $4100; maintenance, $184.

Portland, Ore.—Special.—The contract for constructing 8400 sq. yds. of bitulithic paving was awarded to the Hebe Construction Co. Warren Bros. secured the contract for 44,125 sq yds. of bitulithic paving.

Hartford City, Ind.—Contracts for constructing the Hiatt-Willman and the Chapman macadam roads were awarded, March 7, as follows: Hiatt-Willman road, Clamme Bros., $12,475; Chapman road, William Grady, of Jay county, $7490.

St. Paul, Minn.—The contract for macadamizing Bald Eagle ave. was awarded

March 21 to P. J. Ryan, for $3548. J. J. Mergens was awarded a contract for grading and macadamizing Lexington ave., for $14,680, and the Centerville road, for $9760.

Bloomington, Ill.—The contract for paving Grove st. and Fairview ave. with brick was awarded, March 21, to I. D. Lain, as follows: Danville block, $1.60 a sq. yd.; combined curb and gutter, 40c a lin. ft.; c. i. sewer inlets, $10 each; 12-in. pipe inlets, 40c a lin. ft.; manholes, $24 each.

Mason City, Ia.—Special.—F. P. Wilson, cy. engr., says a contract was awarded to George Gabler, of this city, March 7, for 26,000 sq. yds. of cement concrete paving, at $1.25 a sq. yd.; 10,000 sq. yds. of brick block paving, at $1.90 a sq. yd.; 14,000 lin. ft. cement curbing at 40c a lin. ft.

Portland, Ore.—Bids were submitted March 17 for hard-surface pavements, including asphalt, bitulithic and Hassam, and contracts have been recommended for award as follows: Barber Asphalt Paving Co., 4th and 16th st., $1.80, and Montgomery st., $1.60 a sq. yd.; National Contract Co., 4th st., stone blocks, $20,000.

Green Bay, Wis.—The contract for constructing asphalt paving in Walnut, Dosman, Adams and other streets was awarded to J. F. Hill, of Chicago, March 10. The contract for paving 14 streets with tar macadam and concrete was awarded to the McGrath Construction Co., of this city. W. W. Hatch & Son, of Wabash, secured the contract for brick paving.

Grand Forks, N. D.—Contracts for paving were awarded, March 19, as follows: Dist. No. 11, 38,000 sq. yds. of Donnellite, P. R. McDonnell, $81,000; No. 12, 20,000 sq. yds. of bitulithic, Bitulithic Paving Co., $73,355.50; No. 13, 19,300 sq. yds. of granitoid, R. S. Blome Co., $51,792; No. 14, 8700 sq. yds. of creosoted wood block, Fielding & Shepley, $24,895.

Louisville, Ky.—Bids were submitted March 15 for reconstructing 14 streets with vitrified brick. The bids of Henry Bickel ranged from $1.90 to $1.95 for Rubles block; Staebler Co., Portsmouth granite, $1.87 to $2.05; G. W. Gosnell, Carlisle brick, vitrified brick, $1.85; L. R. Figg & Co., Carlisle block, $1.85. The contract has not yet been awarded.

Louisville, Ky.—Paving contracts were awarded, March 6, as follows: 7th and Magazine sts., vitrified brick, L. R. Figg & Co.; Marshall and Walnut sts., vitrified brick, J. W. Gosnell & Co.; granitoid sidewalks, Lee R. Figg & Co., G. W. Younger & Co., G. W. Gosnell, and the American Concrete Construction Co., at prices ranging from 90c to $1.20 a sq. yd. The prices for vitrified brick paving varied from $1.80 to $1.90 a sq. yd.

Minneapolis, Minn.—Contracts for paving to be constructed during 1910 have been awarded, aggregating $542,288, as follows: Northwestern Lime Co., 40,000 lbs. Portland cement, $1.10 a barrel; granite curbing, Northwestern Granite Co., 65c and 75c a ft.; sandstone curbing, Kettle River Quarries Co.; crushed granite, Western Granite Co., $1.98 a sq. yd.; creosoted wood paving blocks, Republic Creosoting Co., $1.32½ a sq. yd.; vitrified paving blocks, Purington Paving Block Co., 99.8c a sq. yd.; sandstone paving blocks, Kettle River Quarries Co., $1.54 a sq. yd.

Toledo, O.—Paving contracts were awarded, March 7, as follows: Garrigan Bros., Michigan st., Carbovia with concrete foundation and Berea curb, $6,007; grading and macadamizing Cincinnati st. with Carbovia, concrete base and Berea curbing, $4292; Walters & Tansey, repairing City Park ave., vitrified paving block on concrete, Berea curb and asphalt filler, $7565; Columbus st., vitrified paving blocks on concrete, sand filler and Berea curb, $4867; Joseph W. McMahon, grading Ohio st., $650; Ohio Paving Co., repaving Buckeye st. with vitrified paving blocks, concrete foundation, asphalt filler, and Berea curb, $4507.

SEWERS.

CONTEMPLATED WORK.

Akron, O.—The construction of a sewage disposal plant is contemplated.

East Rochester, N. Y.—Voted to appropriate $3,000 for sewer extensions.

Butler, S. D.—The construction of a sewerage system is contemplated.

Brush, Colo.—A sewerage system is contemplated. Mayor Wm. Smith.

Herington, Kas.—Council voted to construct a sewerage system.

Great Falls, Mont.—Council voted to construct sewers to cost $7,645.

Roundup, Mont.—Will vote on the issue of bonds for installing a sewerage system.

DeKalb, Ill.—Plans are being prepared for sewer extensions. A. R. Russel, cy. engr.

Princeton, Ind.—Plans for a sewerage system will be made by Henry Nickamp, cy. engr.

Morristown, Tenn.—Charles E. Collins, of Philadelphia, Pa., has been engaged as engineer for the sewerage system.

Tacoma, Wash.—Will vote soon on the issue of $100,000 bonds for storm sewers. W. C. Raleigh, cy. engr.

Forest Grove, Ore.—Preliminary surveys for a sewerage system are being made by city engr. Richardson.

Albion, Mich.—The construction of sewers is contemplated. J. J. Wiselogel, supt. bd. pub wks.

Tipton, Ind.—This city contemplates constructing a sewer in an alley. Robt. Van Buskirk, cy. engr.

Westport, Conn.—The fire district appropriated March 10. $1,500 for the construction of a sewerage system.

Glenellyn, Ill.—Plans for a sewerage system and disposal plant have been completed, estimated cost, $100,000.

Binghamton, N. Y.—Preliminary steps are being taken preparatory to the construction of an intercepting sewer system.

Philadelphia, Pa.—Ordinances have been passed for constructing sewers in the 9th, 21st, 23d, 41st and 42d ward.

Albert Lea, Minn.—The construction of lateral sewers in the southern and western parts of this city is contemplated.

Chico, Cal.—Will vote on the issue of $35,000 bonds for constructing storm water sewers. B. F. Hudspeth, cy. clk.

Haddon Heights, N. J.—Plans are being prepared for a sewerage system to cost $53,000. F. P. Burkhart, boro clk.

McKeesport, Pa.—The financial committee has appropriated $4,000 for preparing plans for a new sewerage plant.

Columbia, S. C.—The Granby Colton Mills is having plans prepared for constructing 7,000 feet of sewers in Mill village.

Pocatello, Idaho—The construction of a sewerage system at a cost of $150,000 is contemplated. W. A. Samus, cy. engr.

Grinnell, Ia.—The estimated cost of constructing a sanitary sewer on the west side is $25,000. W. F. Beard, cy. engr.

Russellville, Ark.—The construction of a sanitary sewerage system, including a septic tank, is contemplated this season.

Whitefish, Mont.—An ordinance was passed, March 10, providing for the issue

of $10,000 bonds for constructing a sanitary sewer.

Kissimmee, Fla.—Voted to issue $43,000 bonds for constructing sewers and water works. Xavier A. Kramer, engr., Magnolia, Miss.

Paterson, N. J.—A resolution was passed, March 15, providing for the construction of a sewer, at a cost of $137,000. John J. Harder, cy. engr.

Russellville, Ark.—Plans for a sanitary sewerage system, including septic tank, have been prepared by the Fuller-Coult Co., of St. Louis.

Leavenworth, Kas.—Plans have been approved for constructing a trunk sewer in district 9 in the southwestern part of the city. Estimated cost, $21,000.

Bridgeport, Ill.—Plans have been completed and bids will be asked in May for constructing a sanitary sewer. Judge Madeling, chm. bd. local impvts.

Watertown, N. Y.—Will vote in May on the issue of bonds for improvements to include a sanitary sewer in the first ward. E. W. Sayles, cy. engr.

Michigan City, Ind.—The bd. of pub. wks. has ordered the construction of the Willard ave. or prison district sewer, which will be 5,200 feet long and cost $40,000.

Vincennes, Ind.—Hering & Fuller, of N. Y. City, have been engaged to furnish plans for the proposed system of storm and sanitary sewerage, at a cost of $2,500.

Oroville, Cal.—A preliminary report has been submitted to the city council for the proposed sewerage system. Estimated cost, $120,000. B. L. McCoy, cy. engr.

San Francisco, Cal.—An ordinance was passed March 7 providing for the construction of sewers in section D, of the Yerba Buena district, at a cost of $220,000.

Montgomery, Ala.—The Western R. R. of Alabama will construct a concrete sewer and reservoir in N. Court st., at a cost of $10,000. W. N. Cox, supt., Montgomery.

Geneva, N. Y.—Wm. S. Johnson, Boston, has been engaged to act as consulting engineer in the work of planning an investigation of the sewer and water systems. C. T. Church, cy. engr.

Phenix City (Columbus, Ga., P. O.), Ala.—This city will construct 600 feet of sewer pipe across the street at the foot of Summerville hill, and fill in the street. Wiley Rusk, chm. st. com.

Sheboygan, Wis.—The bd. of pub. wks. has recommended the construction of an intercepting sewer from Michigan ave. to the Sheboygan river along Franklin ave., and N. 5th street, to be built this year.

Oswego, N. Y.—L. C. Rowe, Merrick Stowell, Wilson Skinner, Thos. H. King, R. A. Downey and V. J. Maloney have been appointed a commission to investigate the sewer conditions and recommend plans for the necessary improvements.

Pleasant Ridge, O. (Special)—The city council accepted and adopted, March 16, the surveys, maps, plants, designs and estimates of Donald W. Caven, C. E., and surveyor, for a sewerage system and disposal plant including about 15 miles of vitrified pipe sewers, and costing approximately $227,000.

CONTRACTS TO BE LET.

Big Stone Gap, Va.—Bids are asked until April 15 for constructing sewer work. Cy. recdr.

Manhattan, Kas.—Bids are asked until May 3 for constructing a sanitary sewer. C. M. Buck, cy. engr.

Upper Alton, Ill.—Bids will be asked about May 1 for constructing sewers. M. A. Greding, cy. clk.

Ashley, N. D.—Bids are asked until April 4 for furnishing 12 metal culverts. John F. George, co. audit.

Enid, Okla.—Bids are asked until April 21 for constructing a lateral sewer in Garland addition. E. R. Lee, cy. clk.

Fargo, N. D.—Bids are asked until April 28 for constructing a 12 in. lateral sewer in 13th st. N. C. Morgan, cy. audit.

Telluride, Colo.—Bids are asked until April 15 for constructing a sewer system in West Telluride. Jas. S. James, cy. engr.

Indianola, Ia.—Bids are asked until 7 p. m., April 4 for constructing a settling tank and outfall sewers. J. H. Clarke, cy. clk.

North Battleford, Sask.—Bids are asked until April 19 for constructing sewers and sewage disposal works. J. A. Foley, mayor.

Newport, Ark.—Bids are asked until April 27 for constructing 6½ miles of sanitary sewers and a pumping plant. C. S. Henry, secy.

Nevada, Ia.—Bids are asked until April 5 for constructing the Washington-Palestine twp. drainage dist. No. 28. F. G. Dunahugh, co. audt.

Brooklyn, N. Y.—Bids are asked until April 6 for constructing sewers and sewer basins in various streets. Alfred Steers, boro prest.

Toronto, Ont.—Bids are asked until April 19 for constructing section No. 1 high level intercepter. G. R. Grary, mayor and chm. bd. control.

Danville, Ill.—Bids are asked until May 1 for constructing sewers in Fairweight Park and Elmwood Park additions. W. E. Winn, cy. engr.

Comstock, N. Y.—Bids are asked until April 5 for constructing a sewage disposal system. C. V. Collins, supt. State Prisons, Capitol, Albany, N. Y.

Trenton, N. J.—Bids are asked until April 5 for constructing sewers in Styvesant, E. Stuyvesant and Exton aves., Prospect and Marion sts. Harry B. Salter, cy. clk.

Columbia, Mo.—Bids are asked until April 5 for constructing 16,000 ft. of 8 to 12 in. sewers for tile and earthen-ware and 55 manholes. John S. Bicknell, cy. clk.

San Antonio, Tex.—Bids are asked until April 5 for constructing 11 miles of sanitary sewers, including manholes and flushtanks in impvt. dist. No. 7. Bryan Callaghan, mayor.

Louisville, Ky.—Bids are asked until April 8 for constructing 5,198 ft. of concrete sewer in Brook st., requiring 5,000 cu. yds. concrete and 495,000 lbs. steel. Comrs. sewerage.

Charleston, S. C.—Bids are asked until April 5 for furnishing iron castings, Portland and Rosendale cements, terra-cotta glazed pipe, bluestone, granite or gneiss curb, etc. B. P. W.

Canton, Ill.—Bids are asked until April 14 for constructing a system of storm water sewers, changes and additions to sanitary sewer and sewage purification tanks, etc. Joseph Waugh, cy. clk.

Arnold, Pa.—Bids are asked until April 6 by Arnold and New Kensington boroughs for constructing a 48 in. steel reinforced concrete sewer, 2,000 ft. in length in 14th st. George B. Campbell, Jr., boro engr.

Toronto, Ont.—Bids are asked until April 4 for constructing a pipe sewer and appurtenances for the Victoria Industrial School, Mimico. Chester Ferris, supt. Victoria Industrial School, Mimico.

Peabody, Kas.—Bids are asked until April 5 for constructing 4 miles of 8 to 12 in. sanitary sewers, with manholes, lampholes, flushtanks, etc., and a reinforced concrete septic tank. J. W. Mavity, engr.

Newark, N. J.—Bids are asked until April 5 for constructing a storm water drainage system in Park ave., including 10,400 ft. 8 to 24 in. vit. pipe; 1,700 ft. 24, 27 and 30 in. reinforced concrete pipe.; 130 reinforced concrete catch basins; 150 cu. yds. brick masonry; 25,000 lbs. c. i.; 1,000 lbs. wrought iron. A Church, comr. Essex Co., park comrs.

CONTRACTS AWARDED.

Mayfield, Cal.—The contract for sewer construction was awarded to J. Birkett & Sonnicken.

Dayton, O.—The contract for constructing the Hayfies st. sewer was awarded Hecker & Kirschner, for $6,701.

Omaha, Neb.—James Jensen was awarded a contract for building a brick and concrete sewer in Burt, for $46,-968.20.

Canby, Minn.—The contract for constructing a sewerage system was awarded to Tanner Bros., of Webster, S. D., for $24,384.

Pine Bluff, Ark.—The contract for extending the sewers in Mulberry st., 18th, 19th and 20th aves., was awarded to Robinson Bros.

Clinton, Okla.—The contract for constructing pipe sewers was awarded to the the Heman Constr. Co., of St. Louis, Mo., for $17,838.

Plymouth, Wis.—The contract for sewer construction was awarded to Eul, Cochems & Nebel, of Sturgeon Bay, Wis., for $16,065.

Charleston, S. C.—The contract for additional drain trunk at the Navy Yard was awarded to P. D. Hay, of this city, for $29,000.

Medina, N. Y.—The contract for constructing the west side sewerage system was awarded to the F. J. Gotts Co., of Hambery, for $27,750.

Lodi, Cal.—The contract for constructing a sewerage system was awarded Mar. 16 to J. M. Appleton and Frederickson Bros., for $51,226.

Holton, Kas.—The contract for consrucing a sewerage system was awarded to P. A. Johnson & Co., of Kansas City, Mo., for $45,204.39.

Gurley, Colo.—The contract for sewer work in dist. 45 was awarded, March 8, to Spicer & Watson, of Colorado Springs, for $18,659.

Portland, Ore.—The contract for constructing the Brooklyn sewers was awarded, Mar. 11, to Pacquet, Girbisch & Joplin, for $247,000.

Metropolis, Ill.—The contract for constructing a sewerage system was awarded to Reeb Bros., of Belleville, Ill., Mar. 7, for $57.659.

New Britain, Conn.—The contract for furnishing sewer pipe for the fiscal year was awarded to the Warner-Miller Co., of New Haven, for about $15,000.

Franklin, Tenn.—The contract for extending the sewerage and water wks. systems was awarded, Mar. 17, to the Sheffield C. I. Pipe & Foundry Co.

Sterling, Ky.—The contract for constructing a sewerage system was awarded to the Clark County Constr. Co., of Winchester, Ky., for $41,000.

Parkersburg, W. Va.—John W. Curry was awarded a contract, Mar. 9, for constructing a sewer in 22d, 23d and other streets in the 7th ward, for $6,201.95.

Greenfield, Ind.—The contract for constructing a sewer system and light plant for the County Infirmary was awarded to the Clark Lighting Co., and J. W. Fry.

Springfield, Ill.—Robt. E. Goodwin was awarded a contract for constructing a sewer in N. 9th st. at 36 cts. a ft. for the main sewer, 34 cts. for inlets, and $25 each for manholes.

Kansas City, Mo.—The contract for constructing a reinforced concrete pipe joint district sewer in Burch Creek Watershed was awarded, Mar. 18, to Williams & Sample, of this city, for $250,580.

Salt Lake City, Utah.—(Special). The contract for constructing a reinforced concrete conduit in Parley's Creek, south of 12th South st., was awarded to the Moran Construction Co., for $6,085.98.

Rice Lake, Wis.—Bids for constructing a 44 in. concrete sewer and vitrified pipe sewers, with Aylward c. i. catch basins and concrete basins were submitted as follows: E. Knudson, Rice Lake, $50,-450 and $57,170; E. N. Harding Co., $58,-138 and $58,738; Pastoret & Lawrence Co., $58,884 and $60,304.

Muscatine, Ia.—Contracts were awarded, Mar. 10, as follows: For Kecklerville sewer to the Independent Construction Co., of Davenport, Iowa, at $5,873; for Fair Oaks sewer, to the Eppel-Schlosser Co., of Muscatine, at $3,398. James J. Ryan is city engineer.

Monticello, N. Y.—C. S. Lambie & Co., of Pittsburg, Pa., secured the contract, Mar. 17, for constructing a portion of the sewerage system and a garbage disposal plant, for $92,900. The other bids submitted were as follows: L. F. Bannon, Kingston, $116,092; T. C. Rider Co., Monticello, $98,000; John W. Heller, Newark, N. J., $98,712; Albert W. Banker, Gloversville, $114,000; Kellam & Shaffer, Schenectady, $122,600; John B. O'Roarke, Boston, $112,113; Delaware Constr. Co., Sydney, $116,000; Albert Gaffey, Syracuse, $116,771; Chas. Ippolito, Orange, N. J., $100,320.

WATER WORKS.

Bessemer, Ala.—The city council passed an ordinance, Mar. 10, to purchase the city waterworks for $500,000. Mayor Lewis.

CONTEMPLATED WORK.

Elyria, O.—The extension of the water services is contemplated.

Medford, Okla.—Voted to issue bonds for the extension of the water works.

Lordsburg, Cal.—The construction of a water works plant is contemplated.

Harbor Springs, Mich.—Voted to install a waterworks system.

Ft. Erie, N. Y.—Voted to construct a municipal waterworks system.

Ephraim, Utah.—The construction of a water works system is contemplated.

Walthill, Neb.—The construction of a water works system is contemplated.

Lafayette, Ala.—The installation of a waterworks system is contemplated.

McKeesport, Pa.—The finance committee has appropriated $20,000 for new water mains.

Grinnell, Ia.—The estimated cost of 40 blocks of water mains in West Grinnell is $12,000.

Libby, Mont.—Council is considering the question of a municipal waterworks system.

Butler, Pa.—The Butler Water Co. is considering the construction of a reservoir.

Mitchell, Ind.—The question of granting a water works franchise is under discussion.

Houma, La.—The bd. of aldermen has authorized Calvin Wurzlow, mayor, to ask for bids for a pump.

Fenton, Ia.—Voted to issue bonds for constructing a water works system. T. M. Hillsborough, cy. clk.

Oconomowoc, Mo.—An ordinance has been passed for constructing and extending the water works system.

Lafayette, Ala.—Voted to issue bonds for constructing a water works and electric light plant.

Hamilton, Ont.—The construction of new water mains is contemplated. A. H. McCaullum, cy. engr. and mgr. w. w.

Miles City, Mont.—Will vote on enlarging and improving the water works, electric light, and sewer system.

Elberton, Ga.—Additional filter capacity at the water works plant is comtemplated. G. W. Hubbard, supt.

Mart, Tex.—The Commercial Club is considering the construction of a dam to furnish the city with supply of water.

Tulsa, Okla.—Voted $100,000 bonds for improving, extending and maintaining the water works system. B. H. Sand, supt.

Hartford, Conn.—The bd. of water comrs. voted to construct water mains in Kenyon and Magnolia sts. and Shultas Place.

Gadsden, Ala.—J. N. Hazlehurst, of Atlanta, has been engaged as engineer for the proposed improvements to the water works.

Sacramento, Cal.—The East Sacramento Water Co. has adopted plans and specifications for the construction of a concrete tank.

Columbus Junction, Ia.—The business men are in favor of erecting a concrete dam across the Iowa river north of this city.

Bloomington, Ind.—The trustees of the Indiana University have approved plans for a new water plant, and bids will be asked soon.

Minneapolis, Minn.—The water committee has recommended the construction of water mains in numerous streets, at a cost of $400,000.

North East, Md.—Bids will be asked about May 1 for constructing a water works system. G. A. M. Johnson, Leslie, Md., prest. company.

Gainesville, Tex.—The city council voted in favor of the city purchasing the Gainesville water works system for $92,000, and operating it.

Trenton, N. J.—Hering & Fuller, N. Y. City, will make preliminary investigations with a view to constructing a water purification plant.

Defiance, O.—Preliminary plans for a municipal water works system and electric light plant will be made. Chas Behringer, dir. dept. P. S.

Searcy, Ark.—W. S. Shields, cons. engr. of Chicago, estimates the cost of making improvements in water and sewer district No. 1 at $81,000.

Galesburg, Ill.—An ordinance has been referred to the finance committee providing for the issue of $75,000 for the improvement of the water systems.

Duluth, Minn.—The water and light bd. has been authorized to sell $200,000 bonds for extensions and improvements in the water and gas systems.

Boonville, Ind.—Resolutions have been passed ordering the construction of a new city reservoir back of the present lake. Louis Meyer, cy. engr.

Parkersburg, W. Va.—This city will construct a reservoir, pumping station, and pumping engines. The date for receiving bids has not yet been decided upon. Frank Good, cy. audt.

Olathe, Kas.—(Special). L. R. Sykes, cy. clk., says this city will probably vote April 5 on the proposition to erect a standpipe and filter for the waterworks system.

Anoka, Minn.—Will vote April 10 on the issue of $45,000 bonds for constructing a power dam on the Rum river, and for erecting and equipping sub-stations, pumps, transforming stations, etc.

Austin, Tex.—This city will vote April 5 on the proposition of the Dumont-Holmes Steel Concrete Co., of Chicago, to rebuild the dam across the Colorado river above this city, for $1,000,000.

Peru, Ind.—Plans and specifications for installing new machinery and other changes in the water works and lighting systems will be prepared by Smith, Hinchman & Gryih, of Detroit, Mich. T. E. Dunn, cy. clk.

Childress, Tex.—John B. Hawley, of Ft. Worth Tex., has been engaged as engineer for water works improvements, including a pumping station at Lake Childress and laying 10,000 ft. of 8 in. water piping.

Potsdam, Ky.—(Special). Geo. A. Littel, supt. Potsdam w. w., says an appropriation was voted by this village recently for the purpose of investigating the building of a standpipe. Correspondence is solicited.

Toronto, Ont.—The city engineer has been directed to report on the practicability and cost of extending the intake pipe 1,000 ft. further out in the lake and sink it 100 ft. below the surface.

Gilbert, Minn.—C. L. Newberry, Jas. Darling, and O. H. Haenke have been appointed a water, light and power commission to consider the question of installing sewer, waterworks and lighting systems.

Medina, N. Y.—At a joint meeting of the bd. of trustees and the board of water comrs., March 21, it was decided to retain as an auxiliary water supply that part of the old Knowlesville Waterworks plant south of the canal.

Minneapolis, Minn.—Rudolph Hering, of N. Y. City, recommends rapid mechanical filtration of the Mississippi river water, as a means of solving the question of fine water for the city. He estimates the initial cost of the plant at $552,500.

Hillsboro, Ore.—(Special). A. G. Gilmore, supt. Hillsboro Water, Light & Power Co., says this city contemplates sinking additional wells for the public water supply, and would appreciate any information they receive regarding pumping machinery, methods of sinking wells, etc.

Denver, Colo.—This city will vote, May 17, on the propositions, as follows: 1 new, 20 yr. franchise of the Denver Union Water Co., in exchange for which the company will give the city $100,000 bonus a year in fire service. 2. Proposition to issue $17,500,000 bonds for the purchase of the water plant and its improvements either by the city or the united commercial organizations.

Anita, Ia.—(Special). Bruce & Ziegler, attorneys-at-law, advise us that the business men of this city have recently organized a commercial club, which is now investigating the question of a municipal waterworks and light plant. The town has a population of 1,500. It has not water power, and will secure its water from wells. Both plants will have to be run by gasoline or steam engines. Bruce & Ziegler desire names and addresses of parties interested in installing such plants.

CONTRACTS TO BE LET.

Benoit, Miss.—Bids are asked until

April 5 for constructing a waterworks system. M. M. Thompson, mayor.

Quitman, Ga.—Bids are asked until April 6 for constructing a steel tower and tank. J. D. Wilson, mayor.

Florence, S. C.—Bids are asked until April 15 for constructing 7 miles of water mains. M. D. Lucas, cy. secy. and treas.

Madison, Neb.—Bids are asked until April 6 for a motor driven pump, steam boiler, etc. F. J. Danken, cy. clk.

North Battleford, Sask.—Bids are asked until April 19 for constructing water works, concrete reservoir, etc. J. A. Foley, mayor.

Waterbury, Conn.—Bids are asked until May 17 for constructing a new concrete dam in the town of Morris. R. A. Cairms, cy. engr.

Ft. Hancock, N. J.—Bids are asked until April 21 for laying a submarine line of 2,200 ft. of 10 in. universal c. i. pipe. Marietta Water Co.

Cokeville, Wyo.—Bids are asked until April 15 for constructing the Covey Canal, near here. W. Newborough, ch. engr., Evanston, Wyo.

Opelika, Ala.—Bids are asked until April 15 for furnishing water to city service to begin at expiration of present contract. L. F. Kickson, mayor.

Ft. Collins, Colo.—Bids are asked until April 14 for constructing a storage reservoir on Bingham Hill, 6 miles from here. Ross S. Fedder, cy. clk.

Columbus, O.—Bids are asked until April 4 for furnishing 700 tons of c. i. pipe and 25 tons of special castings. H. S. Holton, dir. pub. service.

Meridian, Miss.—Bids are asked until April 5 for constructing 8,500 ft. of 24 in. reinforced concrete conduits. Wm. F. Wilcox, gen'l mgr. water comm.

Ft. Bayard, N. Mex.—Bids are asked until April 18 for constructing the post water main, with installation of fire plug. Capt. S. D. Vestal, Constr. Q. M.

Weston, Ont.—Bids are asked until April 18 for constructing a pump house, mechanical water filters, and electricity operated machinery. T. H. Taylor, clk.

Russellville, Ark.—Bids will be received about June 1 for constructing the proposed water works system. A. B. Brewster, prest. Russellville Water & Light Co.

Madison, Wis.—Bids are asked until April 5 for completing the water mains in the Capitol park and grounds of the Capitol Heat, Light & Power plant, Lew F. Porter, secy. Capitol Comn.

Ft. Collins, Colo.—Bids are asked until April 14 for constructing a reservoir on Bingham Hill with concrete sides and bottom and concrete or frame roof. Robt. S. Fielder, cy. clk.

Detroit, Minn.—Bids are asked until April 4 for constructing 8,560 ft. of 6 in. and 300 ft. of 8 in. water mains; 21 hydrants; 11 gate valves; 4,000 lbs. special castings. Chas. G. Sturtevant, cy clk.

Theodore, Utah.—Bids are asked until April 9 for constructing main irrigating canal from Rock Creek to eastern edge of Blue Bench, 13.56 miles. Jackman Herrick, secy. Upper Blue Bench Irrigation dist.

Newton, Mass.—Bids are asked until April 6 for constructing a pressure tunnel and laying water mains, etc., for the western aqueduct supply main. Henry H. Sprague, chm. Metropolitan water and sewer bd.

Corpus Christi, Tex.—Bids are asked until April 8 for furnishing 4, 6 and 8 in. c. i. water main and c. i. specials, gate valves, hydrants, etc., and for laying 8 miles of water mains. Clark Pease, mayor.

Weyburn, Sask.—Bids are asked until April 27 for constructing power house, mechanical water filters, water works pumping machinery, constructing sewer pipe, sewage disposal works, etc. Geo. Ross, secy.-treas.

Calgary, Alta.—Bids are asked until May 1 for completing the canal system in the eastern section of the company's irrigation block in Alberta. J. S. Dennis, asst. to 2d vice-prest., Canadian Pacific Ry. Co.

CONTRACTS AWARDED.

Salt Lake City, Utah.—(Special). The contract for constructing water mains was awarded to P. J. Moran, for $49,438.60.

Townsend, Wash.—The contract for constructing reservoir No. 2 on Morgan Hill was awarded to Coyne & Son, for $12,482.

Tacoma, Wash.—The contract for laying water mains in Canal, River and 21st sts. was awarded to Bertelson & Sons, for $23,800.

Milwaukee, Wis.—The contract for constructing 4 to 16 miles water mains during the coming year was awarded to Michael O'Donnell, for $15,000.

Baltimore, Md.—The contract for constructing pipe lines throughout Ten Hills, suburban development, was awarded to the Baltimore County Water & Electric Co.

Atlantic City, N. J.—The Heine Safety Boiler Co., of Philadelphia, was awarded the contract for furnishing and installing two boilers at the Absecon pumping station, for $6,466.

Meadville, Pa.—The contract for erecting a brick chimney at the city pumping station was awarded, March 7, to the Heine Chimney Co., of Chicago, for $1,342, without foundation.

Portland, Ore.—The Schaw Batcher Works, of Sacramento, received the contract, March 8, for constructing a steel conduit from the headworks to Mt. Tabor, a distance of 24 miles, for $1,259,782.

Canon City, Colo.—The contract for constructing a complete system of irrigation for the Southern Irrigation Co. was awarded to the Kenefick-Quigley-Hoffman Constr. Co., of Denver, Colo., for $12,000,000.

BRIDGES.

Meadville, Pa.—Plans are being prepared for a bridge over French creek at Mead ave.

Vincennes, Ind.—Bids are asked until April 5 for bridge repairs. John T. Scott, co. audt.

Coffeyville, Kas.—Bids are asked until April 12 for constructing several bridges. Bd. co. comrs.

Noblesville, Ind.—Bids are asked until April 5 for constructing 7 concrete bridges. Geo. Guffin, co. audt.

Decatur, Ind.—Bids are asked until April 4 for constructing a number of bridges. H. S. Michaud, co. audt.

Piedmont, Cal.—The citizens voted to issue $35,000 bonds for constructing a concrete viaduct on Oakland ave.

Goshen, Ind.—Bids are asked until April 5 for constructing bridge and repairs. D. O. Batchelor, co. audt.

Streator, Ill.—Bids are asked until April 4 for building a bridge over the river. John B. Patterson, cy. clk.

Danville, Ill.—Bids are asked until April 4 for constructing a concrete reinforced and steel highway bridge. Co. comrs.

Salem, Ind.—Bids are asked until April

4 for constructing a concrete bridge over Blue river. Sam G. Ellis, co. audt.

Kalama, Wash.—Bids are asked until April 5 for building a steel highway bridge at Castlerock. G. S. Roberts, co. engr.

Elizabeth City, N. C.—Bids will be asked soon for constructing a new bridge across the Pasquotauk river. Camden Ferry Co.

LaPorte, Ind—Bids are asked until April 4, for constructing a bridge over Kankakee river at English lake. C. H. Miller, co. audt.

Lynchburg, Va.—H. L. Shaner, cy. engr., will prepare plans and specifications for constructing a reinforced concrete bridge across James river.

Gretna, La.—Bids are asked until June 1 for building a steel bridge across Harvey Canal in Jefferson Parish. E. M. Hubert, secy. Police Jury.

Shreveport, La.—Bids are asked until April 12 (extension of date), for building a steel traffic bridge over Red river. Geo. R. Wilson, cy. engr.

White Rocks, Utah.—Bids are asked until June 1 for building a steel bridge at Uintah and Ouray Indian agency. Comr. Indian Affairs, Wash., D. C.

Bridgeport, Conn.—Plans for a reinforced concrete bridge over Rooster river on Brooklawn ave., have been prepared by M. F. McKenna, cy. engr.

Bryan, O.—Bids are asked until April 4 for constructing several reinforced concrete sub and superstructures for bridges. R. H. Weaver, co. audt.

Troy, O.—The construction of 3 lift bridges over the Miami and Erie Canal, and 3 bridges over Miami river is contemplated. H. E. Whitlock, co. surveyor.

San Jose, Cal.—Bids are asked until April 5 for constructing a reinforced concrete bridge across Coyote river. Henry A. Pfister, clk. bd. supvrs.

Harrisville, W. Va.—Bids are asked until April 4 for constructing a steel bridge across the north fork of Hughes river, Clay dist. W. R. Meservie, clk. co. comt.

Manhattan, Kas.—Bids are asked until April 7 for constructing a stone arch bridge across School Branch, and a 60 ft. bridge across Deep Creek. Geo. H. Hungerford, co. clk.

STREET LIGHTING.

Allerton, Ia.—Voted to issue bonds for constructing an electric light plant.

Jefferson, Wis.—Will vote April 8 on the question of purchasing a water power site.

Madisonville, Tex.—Plans are under way for constructing an electric light plant here.

Clifton Springs, N. Y.—Voted to issue bonds for enlarging the municipal electric light plant.

Stafford, Kas.—Voted to issue bonds for constructing an electric light and water works system.

Opelika, Ala.—Bids are asked until April 15 for furnishing electricity to city. L. F. Dickson, mayor.

Belton, Tex.—The city council has granted W. F. Thornton a franchise for an electric light plant, for $30,000.

Brownsville, Tex.—Voted to issue bonds for improvements and extensions to the local electric light and power plant.

Hayward, Cal.—Bids are asked until April 6 for the purchase of electric light and power franchise. Bd. city trustees.

Ft. Sill, Okla.—Bids are asked until April 13 for constructing an electric light and power plant and lighting here. Capt. David L. Stone, Q. M.

Camrose, Alberta.—Bids are asked until April 15 for installing an electric light and power plant on 10 yr. franchise. O. B. Olson, cy. secy.-treas.

Albany, N. Y.—Bids are asked until April 7 for constructing 4 hydroelectric power plants on canals, and for lighting 8 locks on 3 three canals. F. C. Stevens, supt. pub. wks.

Otisville, N. Y.—Bids are asked until April 12 for installing an electric light and power plant at Tuberculosis Sanitorium, Ernest J. Lederle, Ph. D., prest. bd. health of N. Y.

Seymour, Ind.—Bids are asked until 12 m., April 21, for electric street lighting and franchise for commercial lighting, requiring 19 arc and 525 tungsten incandescent lights. McMean & Tripp, engrs., Majestic Bldg., Indianapolis.

Rumford, Me.—Bids are asked until April 14 for ledge excavation and masonry cradles for 1,000 ft. of 14 ft. penstock, relief pipe and concrete spillway; machine and building excavation and concrete foundations, brick and concrete station building, etc.; 4,000 cu. yds. ledge excavation; 500 cu. yds. rubble masonry; 120 cu. yds. concrete; 112 cu. yds. brick work. Rumford Falls Power Co.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

Evansville, Ind.—Bids are asked until April 8 for sprinkling 25 streets. B. P. W.

Huron, S. D.—A committee has been appointed to procure a site and install a garbage crematory.

West Point, N. Y.—Bids are asked until April 15 for constructing a garbage crematory. Q. M.

Atlanta, Ga.—Bids are asked until April 29 for constructing a garbage crematory. G. H. Brandon, secy. bd. of health.

Pittsfield, Mass.—The contract for collecting garbage was awarded to John Bros., of Peak's Road, for $79,500, for 5 years.

Boston, Mass.—Bids are asked until May 15 for furnishing watering carts and watering and oiling streets in 10 districts, and for cleaning streets and sidewalks in 4 districts. Guy C. Emercon, supt. sts.

PARKS.

New Rochelle, N. Y.—The question of a public park is still urged.

Hamilton, O.—This city will vote April 16 on appropriating $400,000 for constructing a levee and parks.

New Brunswick, N. J.—The city council has authorized the purchase of a 28 acre tract of land for park purposes.

FIRE APPARATUS.

Clarington, O.—(Special). Col. S. Tachappat says this city needs something to fight fires with, as it has not a water works system.

Harrison, N. J.—Bids are asked until April 5 for furnishing 2,000 ft. of 2½ in. hose for the fire department. Peter Goodman, town clk.

Vancouver, B. C.—Bids are asked until April 21 for furnishing 2 automobile hose wagons, 2 chemical wagons and 1 aerial ladder. Wm. McQueen, cy. clk.